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RESEARCH PROJECT
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ENGINEERING SOILS MAP OF GREENE COUNTY, INDIANA
FINAL REPORT

Gregory L. Johnson

PURDUE UNIVERSITY

Final Report

ENGINEERING SOILS MAP OF GREENE COUNTY, INDIANA

To:	H. L. Michael, Director Joint Highway Research Project	July 7, 1989
		Project: C-36-51-B
From:	Robert D. Miles, Research engineer Joint Highway Research Project	File: 1-5-2-84

The attached report entitled "Engineering Soils Map of Greene County, Indiana," completes a portion of the long-term project concerned with the development of county engineering soils maps of the 92 counties in the state of Indiana. This is the 84th report of the series. The report was prepared by Gregory L. Johnson, Research Assistant, Joint Highway Research Project, under my direction.

The soils mapping of Greene County was done primarily by the analysis of landforms and associated parent materials as portrayed on stereoscopic aerial photographs. Additional information on soils was obtained from publications of the Soil Conservation Service, USDA. Test data from roadway and bridge projects was obtained from IDOH. Generalized soil profiles for the landform/parent materials areas mapped are presented on the engineering soils map. A print of the engineering soils map of Greene County is included at the end of the report.

Respectfully submitted,

Robert D. Miles

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Final Report

ENGINEERING SOILS MAP OF GREENE COUNTY, INDIANA

by

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Research Assistant

Joint Highway Research Project

Project No.: C-36-51-B

File No.: 1-5-2-84

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The author wishes to thank Professor R. D. Miles for the opportunity to work on this project and for his assistance throughout its duration. Recognition also goes to Professor H. L. Michael, Director, Joint Highway Research Project, and the other members of the Joint Highway Research Board for their continued support of the county soil mapping project. Acknowledgment also goes to Xue Weiqing for her drafting skills.

The author finally wishes to thank his parents for their support and encouragement throughout his educational career.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Page

LIST OF APPENDICES

Engineering Soils Map of Greene County, Indiana

INTRODUCTION

The engineering soils map of Greene County, Indiana which accompanies this report was prepared primarily by airphoto interpretation techniques using accepted principles of observation and inference (1). The 7-in. x 9-in. aerial photographs used in this study, having an approximate scale of 1:20,000, were taken in the summer of 1937 for the United States Department of Agriculture and were purchased from that agency. The attached engineering soils map was prepared at a scale ratio of 1:63,360 (1 inch = 1 mile).

Standard symbols developed by the staff of the Airphoto Interpretation Laboratory, School of Civil Engineering, Purdue University, were employed to delineate landform-parent material associations and soil textures. The text of this report represents an effort to overcome the limitations imposed by adherence to a standard symbolism and map presentation.

Extensive use was made of the Agricultural Soil Survey of Greene County completed in September, 1988 (2). It was particularly useful as a cross-reference to check soil boundaries and in locating strip mines, gravel pits, ponds, and stream meanders not present on the 1937 aerial photographs. Also, a reconnaissance trip was made to the county to resolve ambiguous soil boundaries.

The map and report are part of a continuing effort to complete a comprehensive engineering soil survey for the state of Indiana. Therefore, a consistent mapping of soil units

at the boundaries of previously mapped Clay, Owen, Monroe, Lawrence, Martin, Daviess, Knox, and Sullivan Counties was attempted.

Included on the map is a set of subsurface profiles. They illustrate approximate variations that are expected in the general soil profiles of the major soils of each landform-parent material region. The profiles were constructed from information obtained from agricultural literature and from boring data collected for roadway and bridge site investigations (43-61). Boring locations are shown on the map, and Appendix A contains a summary of classification test results for these locations.

The text of this report supplements the engineering soils map and includes a description of the county including climate, drainage features, water supply, physiography, and topography; a discussion of the bedrock and glacial geology; descriptions of the different landform-parent material regions; and a discussion of the engineering considerations associated with the materials found in each region.

The predominant agricultural soils associated with each landform-parent material classification are covered in the discussion of the different landforms in the county. The physical, chemical, and engineering index properties of these soils are included in Appendices B and C.

DESCRIPTION OF THE AREA

GENERAL

Greene County is located in the southwestern part of Indiana as illustrated in Figure 1. It is bounded on the north by Clay and Owen counties; on the east by Monroe and Lawrence; on the south by Knox, Daviess, and Martin; and on the west by Sullivan County. Bloomfield, the county seat, is located in the central part of the county, approximately 70 miles southwest of Indianapolis.

The county has a land area of 546 square miles, or 349,318 acres. The greatest use of land within the county is for agriculture followed by forested lands (2). General land-use categories by area and percent of total area are listed in Table 1.

TABLE 1. LAND USE IN GREENE COUNTY (2,9)

Land Use	Acres	Percent
Agriculture	150,207	43.0
Forested	97,809	28.0
Pasture	69,864	20.0
Mined	15,719	4.5
Urban	13,973	4.0
Water	1,746	0.5
Total	349,318	100.0

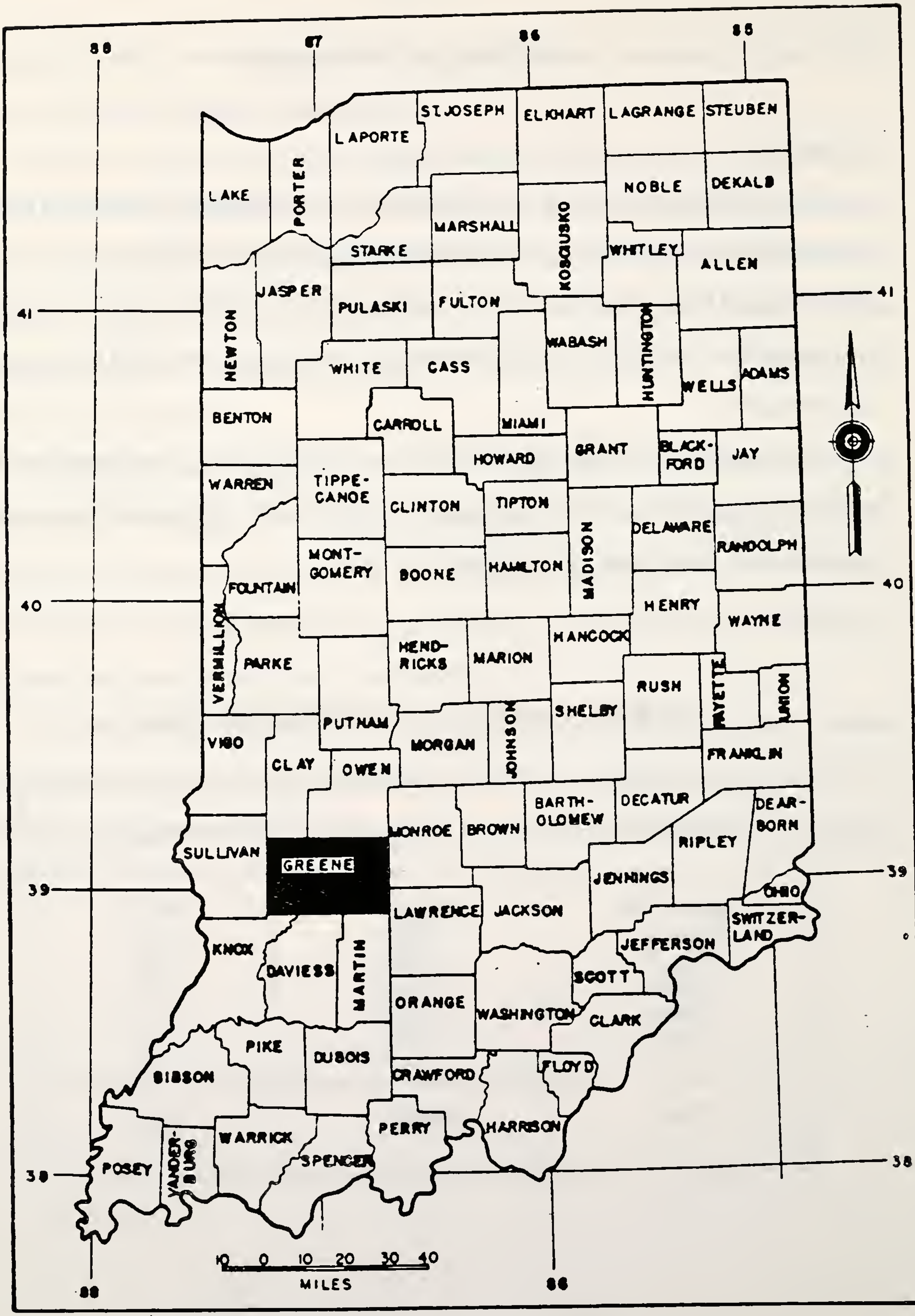


FIGURE 1. LOCATION MAP OF GREENE COUNTY.

Greene County has a population of approximately 30,416 (1980 census). The population increased 13.10 percent between 1970 and 1980. A population summary of cities and towns in the county is given in Table 2.

TABLE 2. POPULATION SUMMARY OF GREENE COUNTY (4).

City/Town	1980	1970	Difference	%Change
Bloomfield	2,705	2,565	140	5.46
Jasonville	2,497	2,335	162	6.94
Linton	6,315	5,450	865	15.87
Lyons	782	702	80	11.40
Newberry	246	295	-49	-16.61
Switz City	300	301	-1	-0.33
Worthington	1,574	1,691	-117	-6.92
Cities/Towns	14,419	13,339	1,080	8.10
Rural Areas	15,997	13,555	2,442	18.02
County Total	30,416	26,894	3,522	13.10

CLIMATE

The climate of Greene County is continental, humid, and temperate with hot summers and moderately cold winters. Table 3 gives data on temperature and precipitation for the area, as recorded at Elliston, for the period 1934 to 1963 (25).

The average winter temperature is 32 degrees F, with the lowest temperature on record being -21 degrees F. In summer the average temperature is 75 degrees F, with the highest recorded temperature being 112 degrees F. The annual precipitation of about 42 inches is fairly evenly distributed throughout the year. The expected average snowfall is 12 inches. Winds blow most frequently from the southwest; however, in one or two of the winter months, prevailing winds are northwest. The highest average windspeed, 12 mph, occurs in the spring (2,25).

TABLE 3. CLIMATOLOGICAL SUMMARY FOR GREENE COUNTY (25).

Month	Temperature (deg F) Mean	Record Max	Min	Precipitation (inches) Mean	Max Day	Mean Snow
Jan	29.9	74	-21	3.29	3.40	2.7
Feb	32.6	71	-20	2.69	2.60	3.2
Mar	41.8	85	-7	3.80	2.55	2.4
Apr	53.3	93	19	3.85	2.95	0.0
May	63.7	101	27	4.71	3.50	0.0
June	73.1	106	39	5.05	4.75	0.0
July	76.8	112	44	3.51	3.37	0.0
Aug	75.5	108	41	3.35	6.70	0.0
Sept	67.9	105	25	2.93	4.60	0.0
Oct	57.2	95	18	2.46	2.70	0.0
Nov	42.4	85	0	3.40	3.39	1.0
Dec	31.9	70	-14	2.78	2.77	2.9
Year	53.9	112	-21	41.82	6.70	12.3

DRAINAGE FEATURES

Drainage features of Greene County are shown in Figure 2, "Drainage Map-Greene County, Indiana," prepared by the Joint Highway Research Project, Purdue University, 1953 (5). Greene County lies within three major watersheds of the State of Indiana as illustrated in Figure 3. Most of the county lies within the White River watershed, while a small area in the extreme northwest corner of the county is in the Wabash River watershed and a small area in the southeastern part of the county is in the East Fork White River watershed (10).

Most of the county, except several sections of land in the southeastern corner which are tributary to Indian Creek and about 15 square miles in the northwestern corner which are headwaters of Busseron Creek, is drained by the White River. The White River enters the northern boundary about three miles east of the middle and follows a south-southwestern course, dividing the county into two nearly equal parts (7).

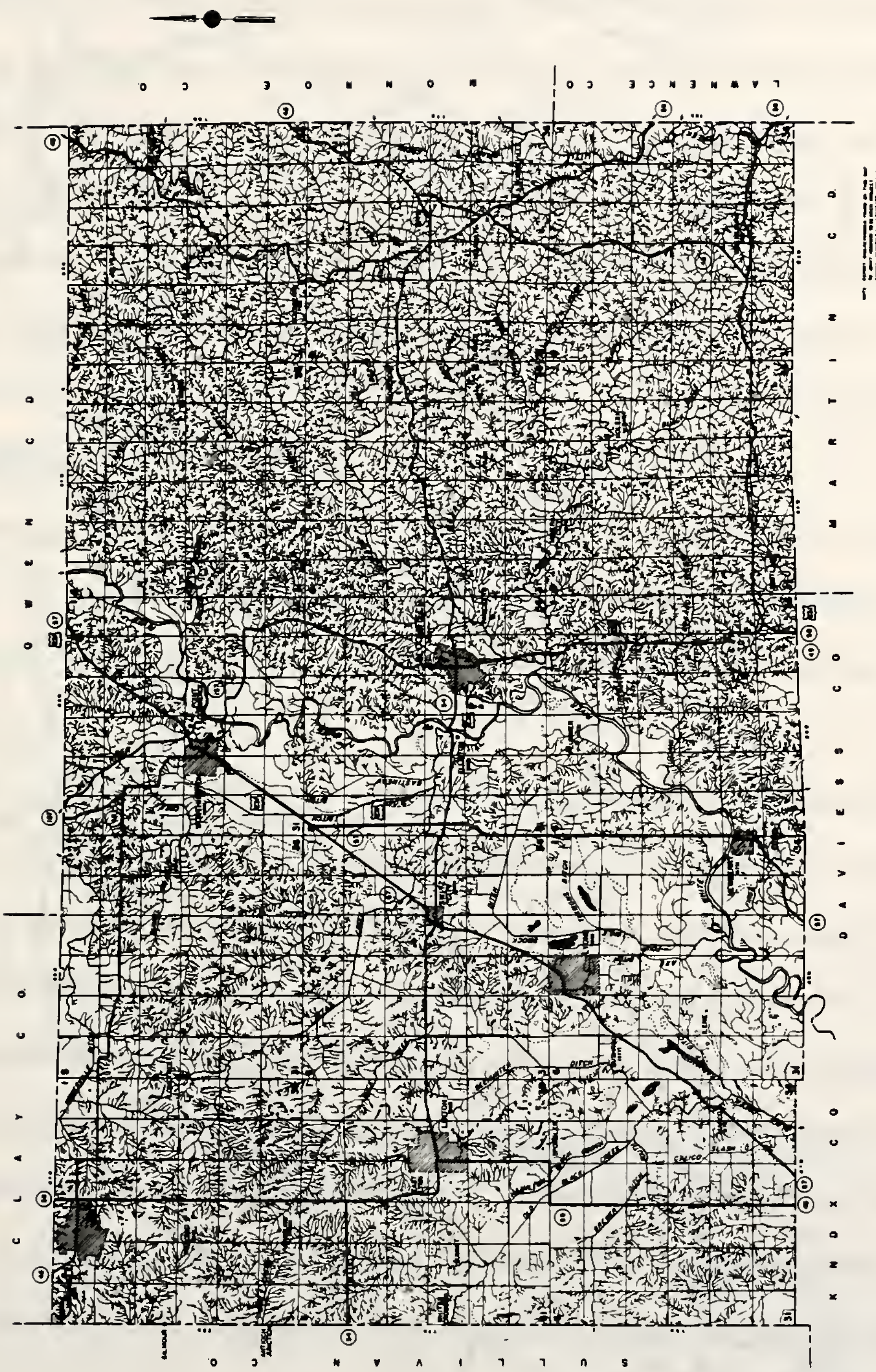


FIGURE 2. DRAINAGE MAP OF GREENE COUNTY (5).

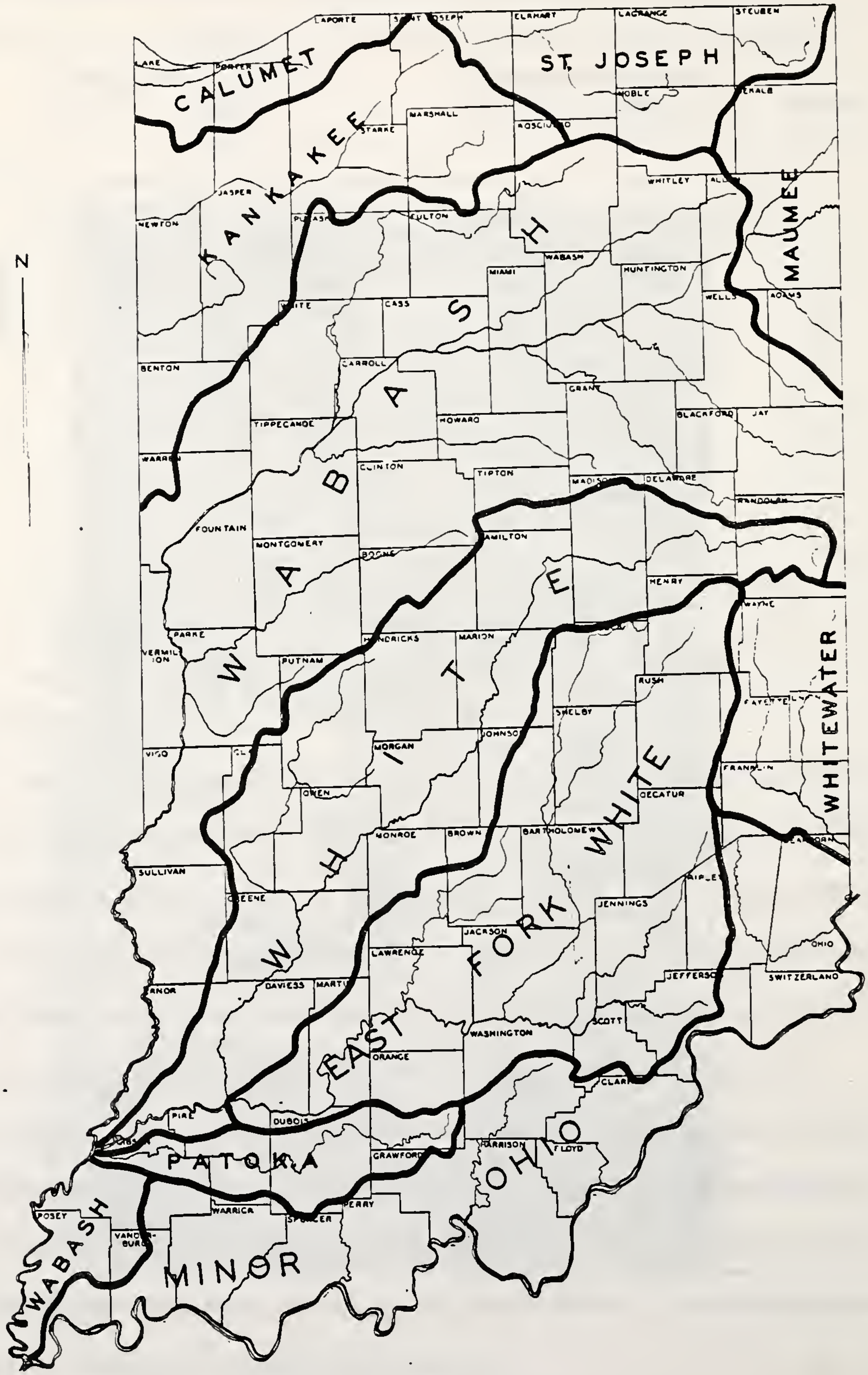


FIGURE 3. MAJOR WATERSHEDS OF INDIANA (10).

Eel River, the largest tributary of the White River, together with two of its tributaries (Howesville Ditch and Lemon Creek) drain about 40 square miles near the northwestern boundary of the county. Lattas Creek, Miller Creek, Sloan Ditch, and Four Mile (or Dixon) Ditch are the tributaries in the western half of the county which empty into the White River. Buck Creek, Beehunter Ditch, Hamilton Ditch North, Old Black Creek, and Hamilton Ditch South are tributaries of Black Creek, which empties into the White River in Knox County (5).

In the eastern half of the county, there are seven tributaries of the White River: Goose Creek, Richland Creek, Beech Creek, Lost Creek, Plummer Creek, Doans Creek, and Black Ankle Creek. Richland Creek, the largest of the seven, cuts almost diagonally across the northeastern corner of the county (5).

The drainage pattern of Greene County can be generalized into five types: modified subdendritic, coarse sub-dendritic, dendritic, anastomotic, and rectilinear. Each pattern reflects the characteristics of the surface and underlying material as well as its topographic expression.

The modified subdendritic type is found in the western half of the county on Illinoian till. The gullies are long, nearly straight and almost feather-like in shape. The coarse subdendritic pattern is found in the eastern portion on interbedded sandstone, shale, and limestone. Between the eastern quarter and the western half, a dendritic type pattern is found on thin Illinoian drift covering the interbedded residual sandstone, shale, and limestone. The flood plain of the White River has the anastomotic drainage pattern usually found in mature valleys. Sand dune and outwash areas, located adjacent to the White and Eel Rivers, exhibit a lack of developed surface drainage. The drainage of the extensive slackwater plains in the western half of the county has been augmented by man-made dredged ditches, creating a somewhat

rectilinear pattern in these areas (5). Also, the courses of several small streams have been interrupted in the western part of the county by strip mining operations.

Drainage density data for selected streams in Greene County is given in Table 4 (6).

TABLE 4. DRAINAGE DENSITY DATA FOR SELECTED STREAMS IN GREENE COUNTY (6).

STREAM AND LOCATION	QUAD	SEC	TWN	RNG	DA	DD
Black Ankle Creek @ Mouth	Koleen	10	6N	4W	8.67	7.5
Bridge Creek @ A. Bottoms	Solsberry	26	7N	4W	8.44	6.8
Clifty Branch @ Mouth	Koleen	3	6N	4W	25.90	6.0
Lattas Creek abv Miller Cr	Switz City	10	7N	6W	21.1	7.9
Lattas Creek @ Mouth	Bloomfield	21	7N	5W	55.4	6.6
Lattas Creek & Miller Cr	Switz City	10	7N	6W	29.1	8.4
Lemon Ditch @ Mouth	Arney	9	8N	5W	12.1	8.1
Miller Creek @ Mouth	Switz City	10	7N	6W	7.94	9.9
Plummer Creek above Rich-land Creek	Scotland	2	6N	5W	66.70	8.6
Plummer Creek above Black Ankle Creek	Koleen	10	6N	4W	13.90	10.6

DA = Drainage Area in square miles
DD = Drainage Density per square mile

Statistical streamflow analyses for the White River (at Newberry) is given in Appendix D. The station analysis includes lowest and highest mean daily discharges; flow duration;

statistics on normal monthly means, log monthly means, log annual means; and annual peak discharges (7).

Low-flow characteristics for the White River (at Newberry), Richland Creek (near Bloomfield), Lattas Creek (at Switz City), and Plummer Creek (near Bloomfield) are given in Appendix E. Selected low-flow frequency and flow-duration values are given for all four streams. Also, annual and summer (June-August) low-flow frequency data are presented as well as duration data for the selected periods: 3 months (June-August), 3 months (August-October), 6 months (May-October), and 12 months (October-September) for the White River (8).

There are no glacial lakes in the county; however, numerous oxbow lakes have developed from abandoned meanders of the White and Eel Rivers. Also, lakes formed by coal-strip mining are abundant in the western part of the county and water filled gravel pits are found adjacent to the White River. Occasionally sinkholes are seen in the area where limestone outcrops in the southeastern part of the county. In this region subterranean drainage may contribute to the immediate runoff of the streams crossing the area (5).

WATER SUPPLY

Greene County is located within two groundwater sections of the State of Indiana as illustrated in Figure 4. The western two thirds lies within the Mississippian and Pennsylvanian Sandstones Section, while the eastern one-third is in the Mississipian Limestones Section (10).

In Greene County groundwater is available from glacial sand and gravel deposits and from bedrock of Pennsylvanian and Mississippian ages. Development potential of these aquifers depends on thickness, areal extent, permeability, and recharge. Bedrock aquifers

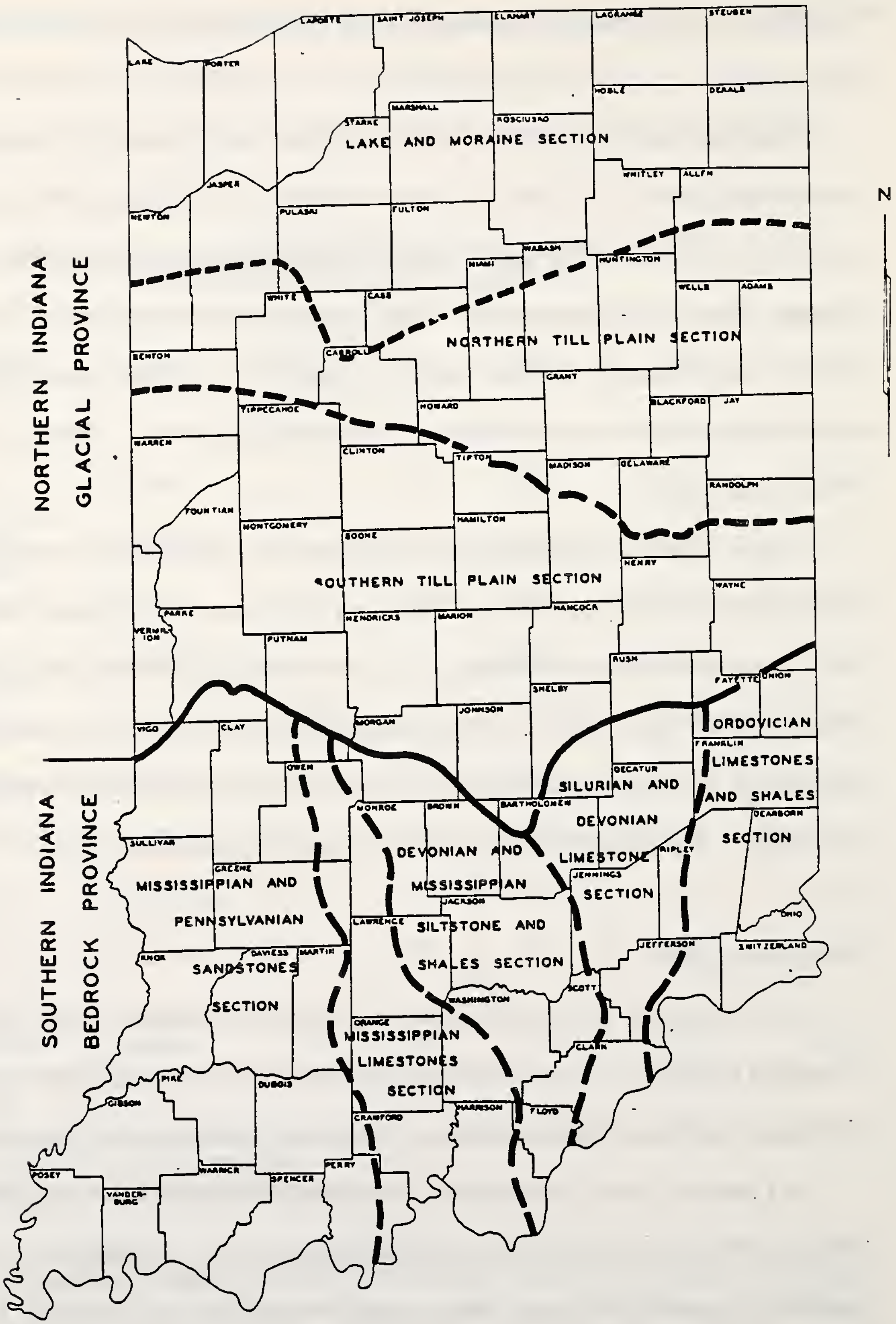


FIGURE 4. GROUNDWATER SECTIONS OF INDIANA (10).

underlie nearly all parts of the county, but have a lower development potential than the more localized sand and gravel aquifers.

For groundwater purposes, glacial sand and gravel deposits in Greene County can be classified into two groups: (1) valley train or outwash and (2) lenses in till or lacustrine sediments.

The flood plains and outwash terraces along Eel River and White River have the highest potential for groundwater development in the county. These unconfined aquifers, as thick as 100 feet, yield several hundred gallons per minute to more than 1000 gallons per minute (9). The hydraulic conductivity of these aquifers is typically 2,000 gallons per day per square foot and recharge, directly from precipitation or seepage from valley walls, is estimated to be 350,000 gallons per day per square mile (9). These aquifers provide the towns of Bloomfield and Worthington along with some adjacent rural areas with their water supply.

Isolated lenses of sand and gravel within the Illinoian till or slackwater deposits in western Greene County have high yields but low development potential. These lenses, as thick as 25 feet, are usually found by trial and error. However, geophysical techniques could be used in some cases. Wells in the thicker and more widely distributed lenses can yield as much as a few hundred gallons per minute, while wells in the thinner and less widely distributed sand and gravel lenses yield only a few gallons per minute. The hydraulic conductivity of these deposits is probably the same as that of the outwash aquifers, but recharge is only about 125,000 gallons per day per square mile because all recharge travels vertically through the confining layers (9). Water wells in Buck Creek Valley (slackwater plain) supply the town of Linton with its water supply (2).

In the glaciated part of the county, bedrock aquifers are used where till is too thin to contain adequate sand and gravel lenses or where outwash aquifers are not present. In this

upland region groundwater is obtained predominantly from sandstones in the Mansfield Formation or from the basal sandstone of the Staunton Formation (16). Well depths in this region range from about 75 to 150 feet deep. Yeilds from these wells generally range from one to 20 gallons per minute. The hydraulic conductivity of these Pennsylvanian aquifers is typically 25 gallons per day per square foot. Recharge amounts to about 60,000 gallons per day per square mile. Precipitation recharges the aquifers at their outcrops, either directly or by percolation through overlying glacial deposits (9). These aquifers are used mainly for domestic and livestock water supply (2).

Although the unglaciated eastern portion of the county contains some Illinoian outwash and lake deposits, the bedrock is generally the only ground-water source (9). These aquifers are Pennsylvanian (mentioned above) and Mississippian in age.

Limestone and sandstone of Mississippian age are sources of small groundwater supplies. These aquifers are similar to Pennsylvanian age aquifers in hydraulic conductivity and recharge. The Chesterian Series, especially the Stephensport and West Baden Groups, consist of porous sandstone and limestone, interbedded with impermeable shale. These aquifers can maintain small-yield wells, generally less than five gallons per minute. The underlying Blue River and Sanders groups are dense, fractured limestones. The dense limestone is not an aquifer, but water can be removed from crevices and solution cavities. Yields are usually less than 10 gallons per minute, however in small areas may yield more than 100 (9).

In areas of eastern Greene County, where water supply from wells is low, water is pumped from wells in the White River bottom lands and hauled from other sources. Also, in some areas where groundwater yields are insufficient, small ponds have been constructed for water supply, fire protection, and wildlife habitat (2).

The maximum well yield that can be expected in a particular area of Greene County is shown on Figure 5. This generalized map is representative of all aquifers, glacial and bedrock (9).

The quality of water from drilled wells in Greene County varies greatly. In some areas the concentration of iron, chloride, or sulfate exceeds the U.S. Public Health Service (1946) standards for drinking water (2).

PHYSIOGRAPHY

Greene County lies within two physiographic units of the State of Indiana, the Wabash Lowland in the western part of the county and the Crawford Upland in the eastern portion as shown on Figure 6. In respect to its physiographic situation in the United States, the eastern third is in the Interior Low Plateau province, and the remainder is in the Till Plains section of the Central Lowland province (3).

The Wabash Lowland is characterized by broad flat uplands that are dissected by gently sloping to strongly sloping drainageways with flat bottom lands along streams. The Crawford Upland is characterized by ridge and valley topography with gently or moderately sloping ridges that are separated by steep or very steep sided valleys with flat bottom lands along streams (2).

TOPOGRAPHY

The surface of Greene County varies from nearly level flood plains, outwash plains and terraces, and slackwater plains and terraces to rolling uplands. It is a partly glaciated till plain and partly a residual upland dissected by White River and its tributaries. The general topography of Greene County is shown on Figure 7. The highest elevation in the county is about 930 feet above sea level, in an area of Beech Township in northeastern Greene County.

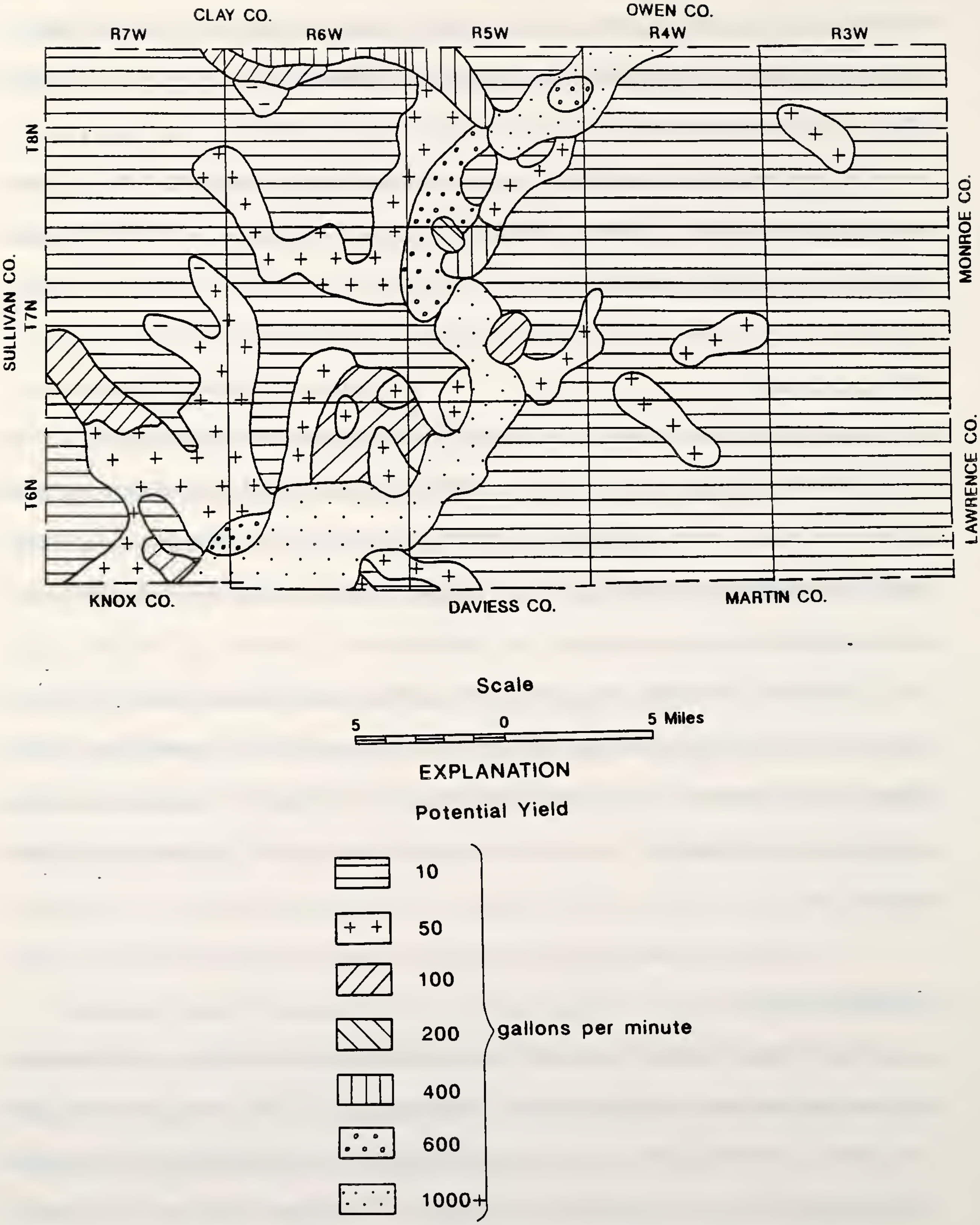


FIGURE 5. GENERALIZED GROUNDWATER AVAILABILITY IN GREENE COUNTY (9).

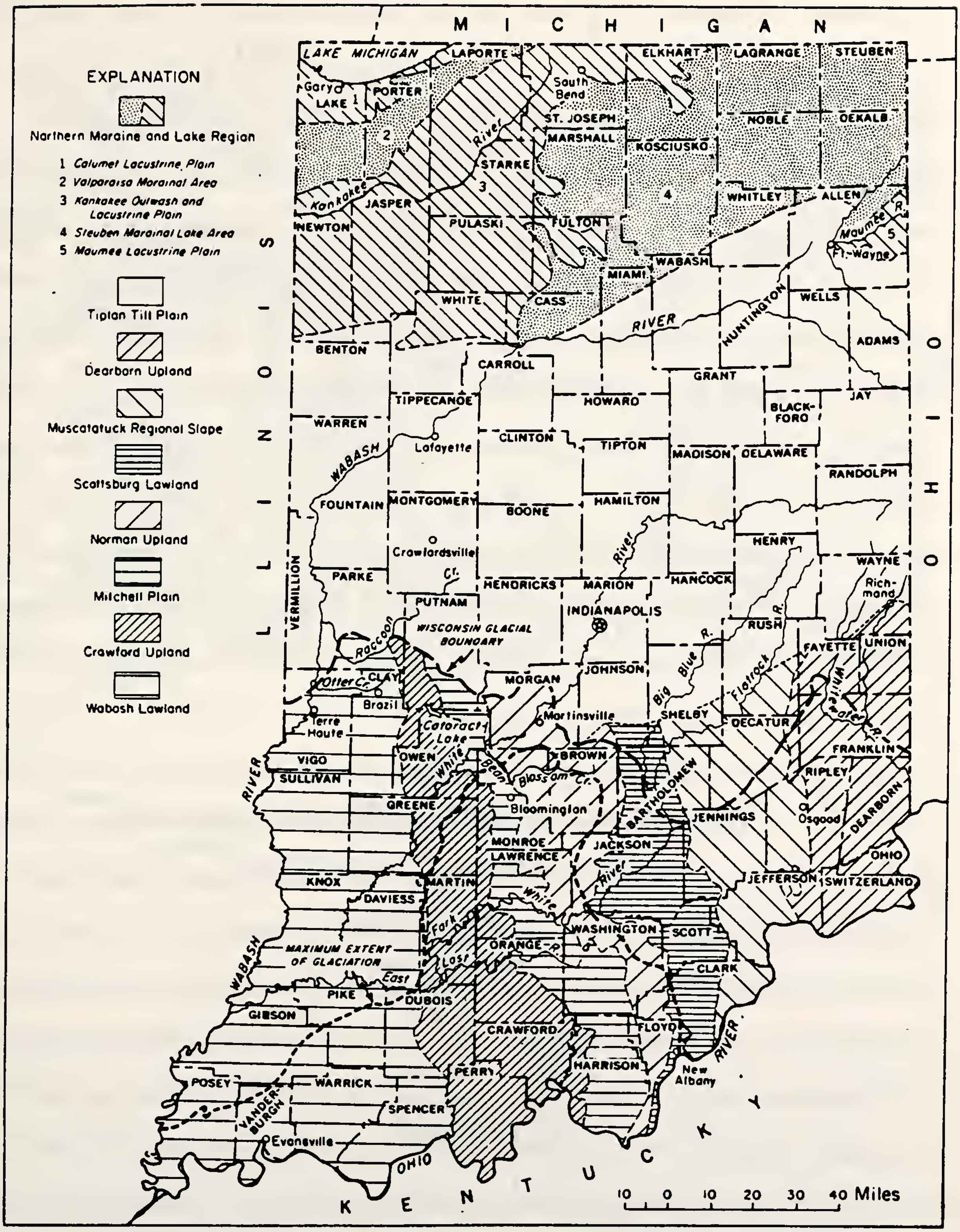


FIGURE 6. PHYSIOGRAPHIC UNITS AND GLACIAL BOUNDARIES IN INDIANA (11).

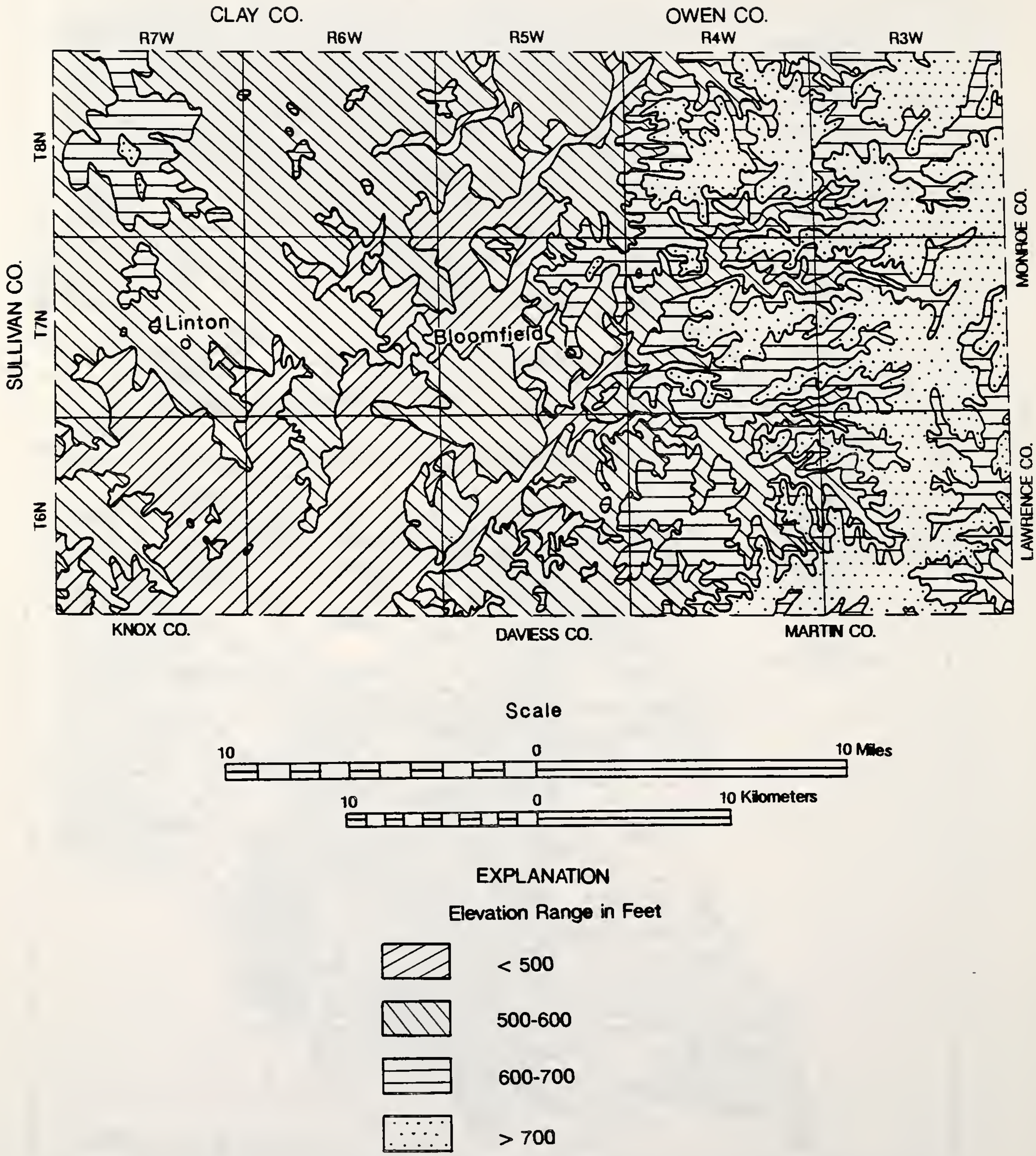


FIGURE 7. TOPOGRAPHY OF GREENE COUNTY (13,14).

The lowest is about 470 feet, in an area along the White River southeast of Newberry (2). Maximum local relief is approximately 300 feet.

The White River valley varies in width from a mile to several miles and is gently sloping with elevations less than 500 feet. The surface of outwash terrace remnants adjacent to the White River slope downstream with a gradient of approximately eight inches per mile. In the western half of the county, broad level flats are located within the tributary valleys of the White and Eel Rivers. The elevation of these lacustrine (slackwater) plains decreases downstream in successive tributaries in accordance with valley train filling and subsequent tributary ponding during Wisconsinan glaciation (12). Slackwater plains associated with Howesville Ditch, Lemon Creek, Sloan Ditch, Lattas Creek, Fourmile Ditch, Buck Creek, Beehunter Ditch, and Black Creek, tributaries of the White and Eel Rivers from north to south, range in elevation from about 515 feet in the north to approximately 480 feet in the south (12). The level topography of the flood plains, terraces and slackwater plains of the western portion of the county is modified in numerous locations by abandoned channels and sand dune development. The terrain of the sand areas consists of small mounds and low ridges together with irregular shaped interdunal depressions.

The western uplands, Illinoian till mantled by loess, consist of gently rolling to rolling relief as the result of moderate stream dissection. However, some interstream divides are low and nearly level. The eastern residual upland is rough and broken. The valleys of the creeks in this area are generally narrow, less than a quarter of a mile in width; however, along Richland and Plummer Creeks they occasionlly widen to one-half mile. The interstream areas in this part of the county are deeply dissected by secondary tributaries. The hillsides and ridges which lead up to the crests of the major divides present every degree of slope and variety of form. The relief is so varied that no general description will apply to all of it. Between the Illinoian

drift boundary and White River much of the surface is rolling, with very rough land confined, for the most part, to the neighborhood of the creeks, but east of the limit of glaciation there are many bold outcrops of sandstone, shale, and limestone. There are a few sinkholes in the southeastern part of the county (5).

Nearly level Illinoian slackwater terraces, formed near the margin of the glacier, are located along Richland Creek near Hendricksville, along Doans Creek near Scotland, and in areas of the "American Bottom" along Plummer Creek. Illinoian outwash plains are found in association with these slackwater deposits in the uplands west of the Doans Creek and "American Bottom" slackwater terraces.

GEOLOGY OF GREENE COUNTY

The surface and near surface geology of Greene County consists of bedrock of the Paleozoic Era and unconsolidated deposits of the Quaternary Period. The bedrock lithologies are mainly sandstones, shales, and limestones of the Mississippian and Pennsylvanian Periods. The Quaternary sediments were deposited by glacial processes during the Pliestocene Epoch and reworked by wind and water during that period and in Recent times, or have resulted from weathering of bedrock.

BEDROCK STRATIGRAPHY

Greene County lies within two bedrock physiographic units of Indiana, the western part in the Sullivan Lowland and the eastern part in the Crawford Upland (3). The county is underlain by rocks of Pennsylvanian age that dip southwest at 25 to 30 feet per mile and of Mississippian age that dip 40 feet per mile into the Illinois Basin (Figures 8,9). Western

Greene County is located in a minor shallow syncline which is separated from the rest of the Illinois Basin by the LaSalle anticline (Figure 9). The Block Coals, Coal III, and Coal IV are thicker and more persistent in this syncline than anywhere else in the basin (17).

Mississippian rocks of the Chesterian Series underlie most of the eastern one-third of the county. The rocks consist of alternating beds of shale, sandstone, and limestone. The bedrock landforms typically consist of trenchlike, flat-bottomed valleys, rock benches, and local structural plains (2).

The main rock units near the surface in a two to five mile strip along the eastern edge of the county are part of the West Baden Group. They consist mostly of shale, with some thin-bedded and crossbedded sandstones of the Elwren, Sample, and Bethel Formations, and the Reelsville, and Beaver Bend Limestones. The Bethel Formation, the oldest formation of the group, contains some thin coal layers. The cap rock on some of the highest ridges in this portion of the county is part of the Stephensport Group, which consists mostly of cliff-forming sandstone and shale of the Big Clifty Formation and the Beech Creek and Haney Limestones (2,9).

Significant areas of limestone rock are near the surface or exposed along the deep valleys of Richland Creek near Hendricksville and Little Indian Creek east of Owensburg. These rocks are assigned to the Ste. Genevieve and Paoli Limestones of the Blue River Group (2).

In the part of the county near Koleen, Ridgeport, and Solsberry the main rocks near the surface are in the Stephensport Group and consist mostly of sandsone, shale, and limestone of the Haney Limestone, Big Clifty Formation, and Beech Creek Limestone. The cap rocks on some of the highest ridges are Pennsylvanian in age and consist mainly of sandstone and shale of the Mansfield Formation (Raccoon Creek Group). The basal Pennsylvanian Mansfield Formation overlies Mississippian rocks with a pronounced erosional unconformity.

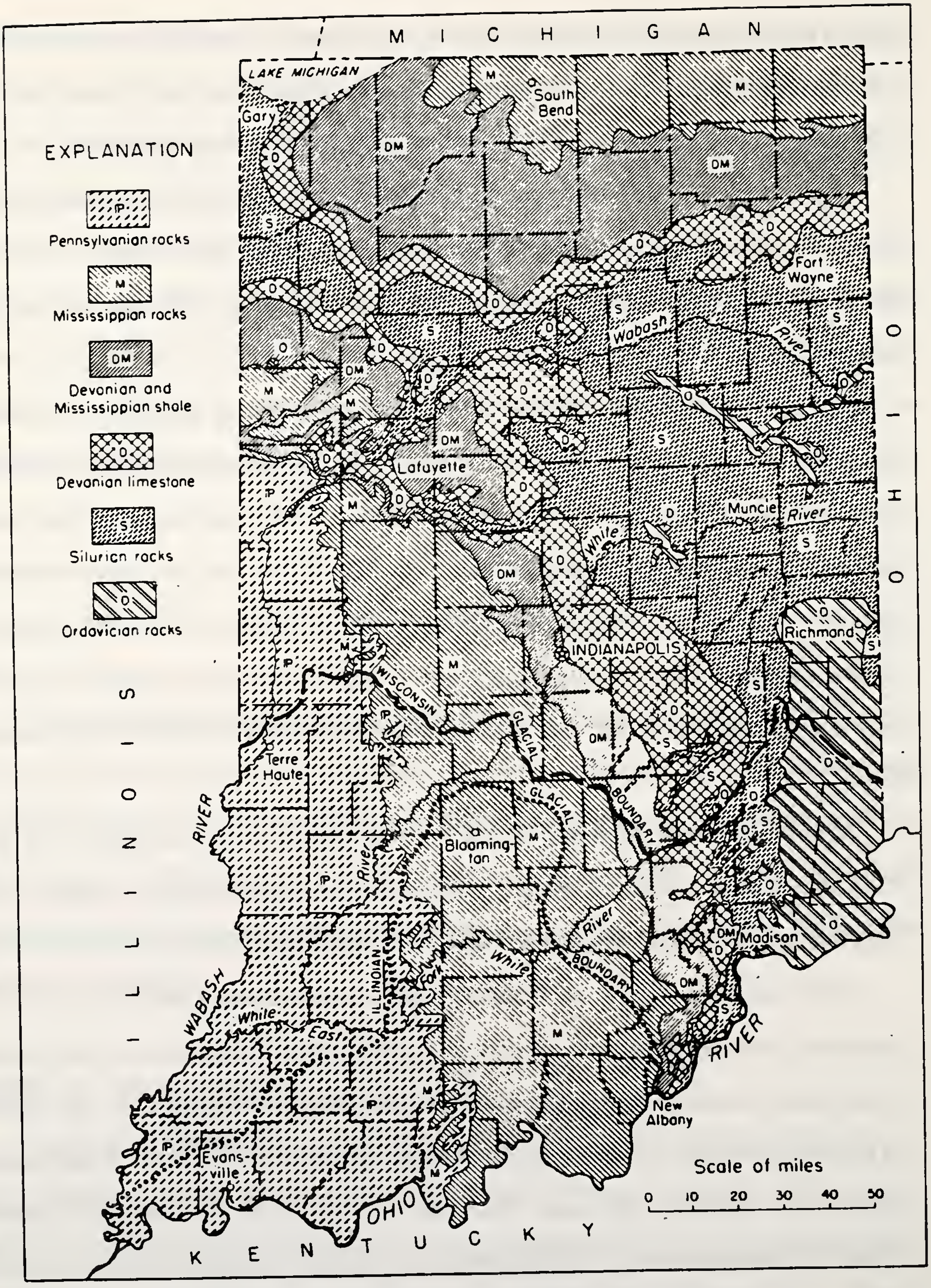


FIGURE 8. BEDROCK GEOLOGY OF INDIANA.

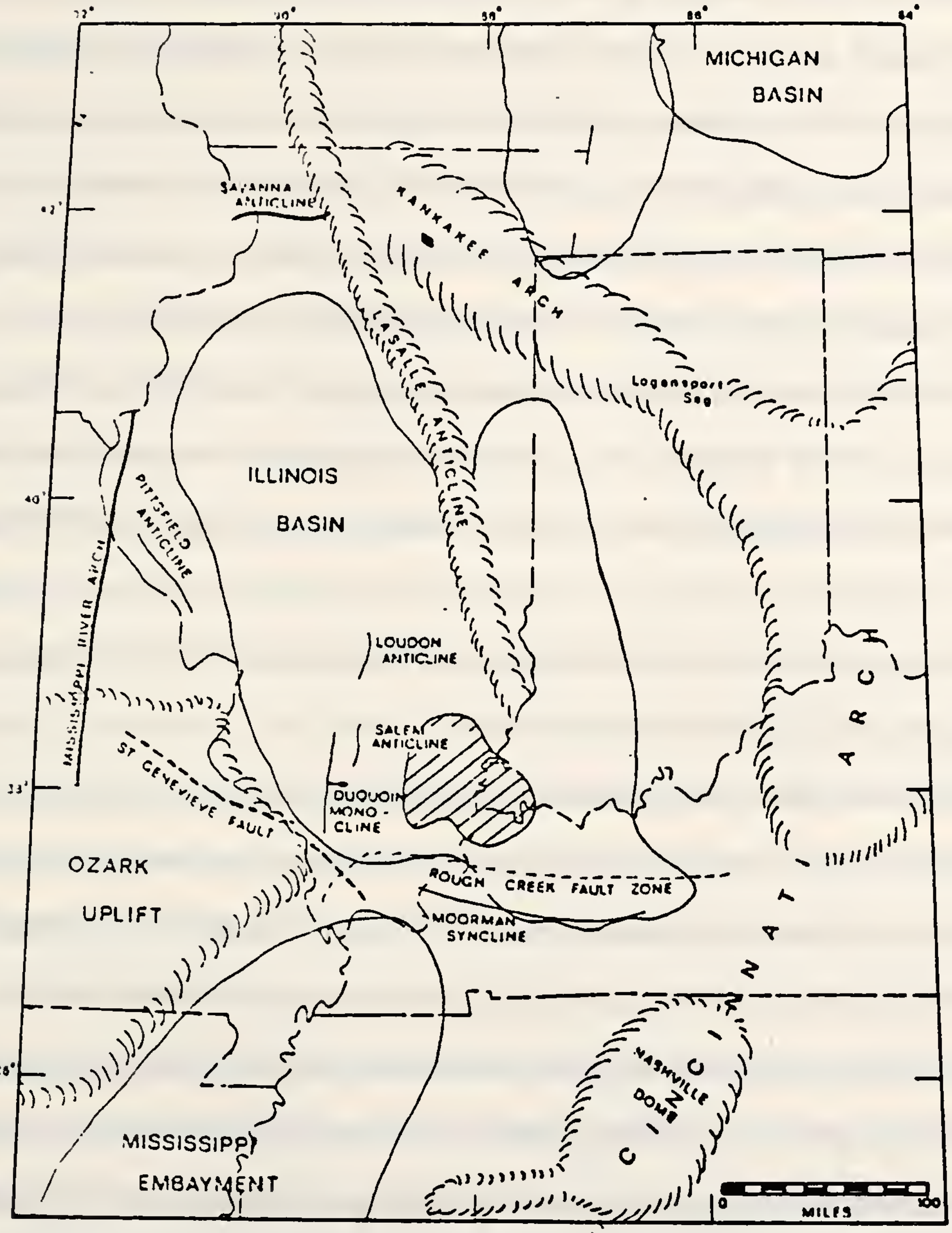


FIGURE 9. STRUCTURAL SETTING OF GREENE COUNTY.

The beds of the Mansfield are characteristically light-gray to gray, cross-bedded, ripple-marked sandstones that weather to rust-brown honeycombed bluffs. The upper one-fifth of the formation is locally a blue-gray shale. A thin dark-gray limestone and associated black shales occur in places near the top of the formation and are probably correlative with the Ferdinand Limestone of southern Indiana. Lenses of minable coal are locally present at several horizons within the Mansfield Formation (15).

Pennsylvanian rocks, which are younger than the Mansfield Formation, underlie the western two-thirds of the county. This bedrock typically occurs as a sequence of shale, sandstone, mudstone, limestone, and coal. These rocks are assigned to the Brazil, Staunton, Linton, Petersburg, and Dugger Formations. Most of this area is covered by Illinoian till and Wisconsinan proglacial deposits; therefore, rock outcrops are limited to strip pits, road cuts, and deeply eroded stream valleys (2).

The Brazil Formation (Raccoon Creek Group) is divisible into eight units, from base upward, as follows: the Lower Block Coal, which averages two feet thick; blue-gray to gray shale with thin sandstone laminae, nine to 36 feet thick; the Upper Block Coal and its underclay, three to seven feet thick; a hard gray sandstone overlain by a gray sandy concretionary shale, 15 to 36 feet thick; the Minshall Coal and its underclay, several feet thick; black to dark-gray shales and the Minshall Limestone, with the shales being about five to 16 feet thick and the limestone two to 14 feet thick; gray sandy shale and light-gray sandstone, about 12 feet thick; and Coal II, about six inches thick (15).

In many places the upper beds of the Brazil Formation were removed by erosion, and the basal sandstone of the Staunton Formation rests on the Minshall Limestone or lower horizons (15).

The Staunton Formation (Raccoon Creek Group) is 19 to 55 feet thick in western Greene County where it can be differentiated. The basal member is a light-gray, cross-laminated, micaceous, massive sandstone which varies greatly in thickness as it fills channels and depressions on a pre-Staunton surface. The sandstone is overlain by blue-gray sandy shale, which underlies the underclay of Coal III (15). In the Jasonville area, Coal III is 4.4 to 6.3 feet thick and contains considerable pyrite in thin bands. A shale parting or "dirty band," one inch to more than 24 inches thick, is always present. Locally, the parting thickens to 10 feet or more, a fact which has lead to some confusion in the identification of one of the two parts of Coal III. The roof of Coal III is either gray laminated shale or brown micaceous friable sandstone (17).

The Linton Formation (Carbondale Group) includes the rocks in the interval between the stratigraphic break above Coal III and an unconformity above Coal IV. This unit includes sandstone, shale, limestone, and Coals IIIa and IV. It is 65 feet thick, and is well-developed near Linton, the type locality. Coals III and IIIa commonly are separated by 15 to 20 feet of sandstone and shale. Locally, the 15- to 20-foot unit is brown friable sandstone or gray shale and sandstone that contains a 2-foot bed of highly calcareous sandstone. Coal IIIa (Colchester Coal) has a uniform thickness, which averages about nine inches in the area. It is not mined commercially. Black fissile shale two to five feet thick, is present everywhere above Coal IIIa. This black shale grades up into 1.5 feet of black, impure limestone that has been correlated with the Oak Grove Limestone. Above the limestone and below Coal IV is 25 to 35 feet of alternating sandstone and shale. Coal IV, the Survant Coal, is underlain locally by gray arenaceous shale or thin lenses of sandy fire clay. Coal IV is best developed around Linton and averages more than four feet in thickness. Coal IV, like Coal III, locally has a medial shale parting from one inch to 36 inches thick. The parting is nearly three feet thick along a strip

mine outcrop in the eastern half of section 34, T9N, R7W, where 2.5 feet of coal occurs above the parting and 2.4 feet of coal below it. Coal IV contains much less pyrite than Coals III and V. The roof above Coal IV in most places is gray shale, but locally is sandstone (17).

The Petersburg Formation (Carbondale Group) is made up of four named members in ascending order, the Houchin Creek Coal (IVa), Stendal Limestone, Fosomville, and Springfield Coal (V) Members, and unnamed beds of shale, sandstone, and underclay. Coal IVa averages 1.5 feet in thickness and grades upward into a black fissile shale which averages 3.4 feet in thickness. Above the shale is a one- to three-foot thick, irregular, wavy bed of black, impure limestone (Stendal) that is overlain locally by a few feet of black, soft shale. The remainder of the 50 to 100 feet between Coals IVa and V is platy or massive sandstone. Coal V is as much as 11 feet thick, the thickest coal in the area. However, it is not mined extensively in Greene County because it contains a large amount of pyrite in irregular thin bands and, south of Jasonville, becomes dirty and shaly. Also, irregular gray argillaceous sandstone lenses occur in several localities throughout Coal V except in the lower 2.5 feet. Coal V is generally overlain by four to 6.5 feet of well-jointed black shale. The upper half of the shale is soft and weathers readily, and the lower half is fissile but appears massive on the excellent joint planes. Iron concretions are numerous in the lower two feet of the shale and range from less than one inch to 37 inches in diameter (17).

The Dugger Formation, the uppermost formation in the Carbondale Group, includes in ascending order the Bucktown (Vb), Herrin, Hymera (VI), and Danville Coal (VII) Members; the Alum Cave, Antioch, Providence, and Universal Limestone Members; the Anvil Rock and Bridge Junction Sandstone Members; and unnamed beds of clay, sandstone, and shale. The basal unit of the formation is commonly an unnamed black, fossiliferous, fissle shale that contains concretions of ironstone and limestone as much as three feet in diameter. In places

a thin pyritic limestone underlies the black shale. The name Dugger Formation was first used to describe 70 to 120 feet of rock exposed two miles northeast of Dugger, Sullivan County. In Greene County, however, only the lower 18 feet of the Dugger Formation is seen in strip mine exposures (17).

The stratigraphy of the Mississippian and Pennsylvanian formations and coal members that underlie Greene County is shown in Figure 10 (19,20). Also, the areal extent of the Mississippian and Pennsylvanian groups is given on Figure 11 (19,20).

The general bedrock topography of Greene County is illustrated in Figure 12 (18). Bedrock exhibits the highest elevations, of greater than 900 feet above mean sea level, in the northeastern portion of the county and the lowest, of less than 400 feet, in the White River Valley.

PLEISTOCENE GEOLOGY

The western two-thirds of Greene County was covered by Illinoian ice, whose eastern limit corresponds approximately with a line drawn through Newark and Scotland. Prior to glaciation most of the bedrock slopes had moderate subdued relief where weak shales permitted valley widening to a greater extent than in areas of more resistant rocks. The glacial till generally ranges from a few feet to more than 50 feet thick (2). It consists of mixture of sand, silt, and clay and is usually thinner east of the White River where bedrock is exposed in many places in draws and on side slopes.

During Illinoian glaciation some valley filling occurred near the margin of the glacier. Glacial outwash, consisting of sand and gravel, is found near Park and Scotland. Also, several marginal lakes developed against the ice front as a result of the damming by the ice of the westward and southwestward drainage in eastern Greene County (12).

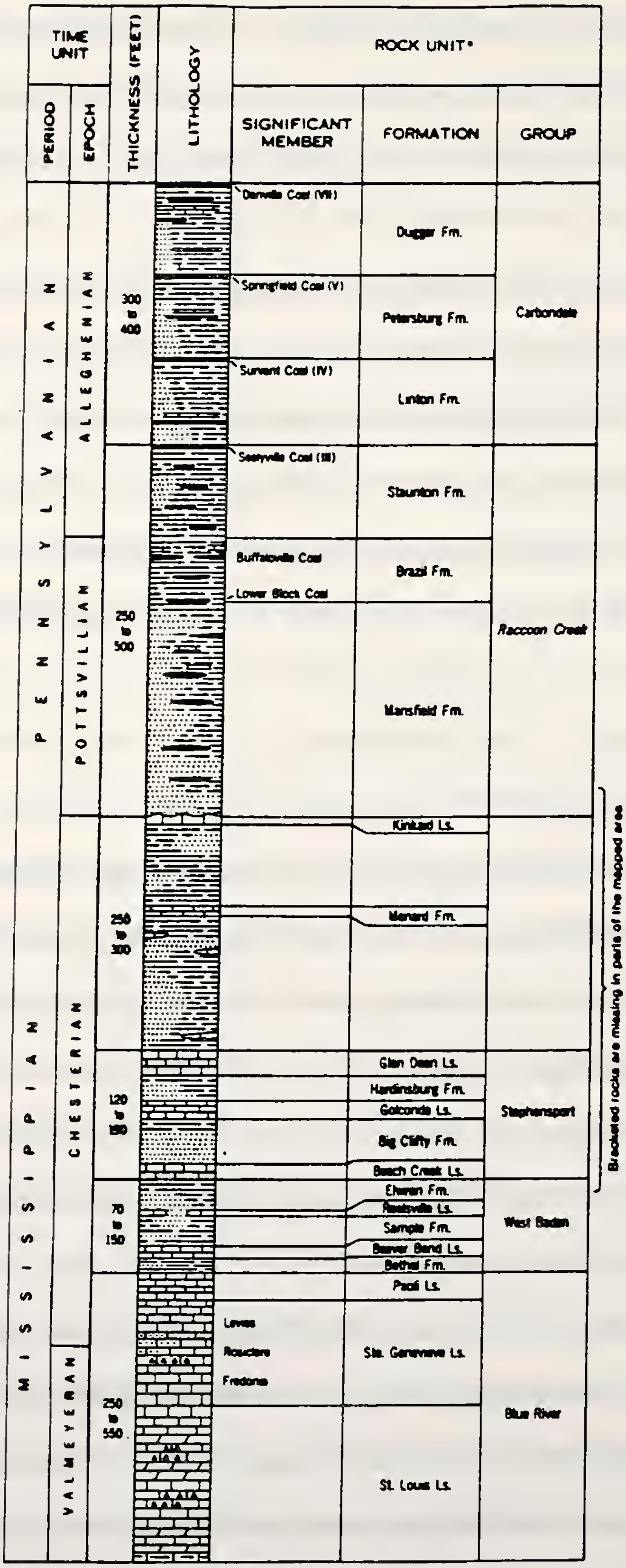
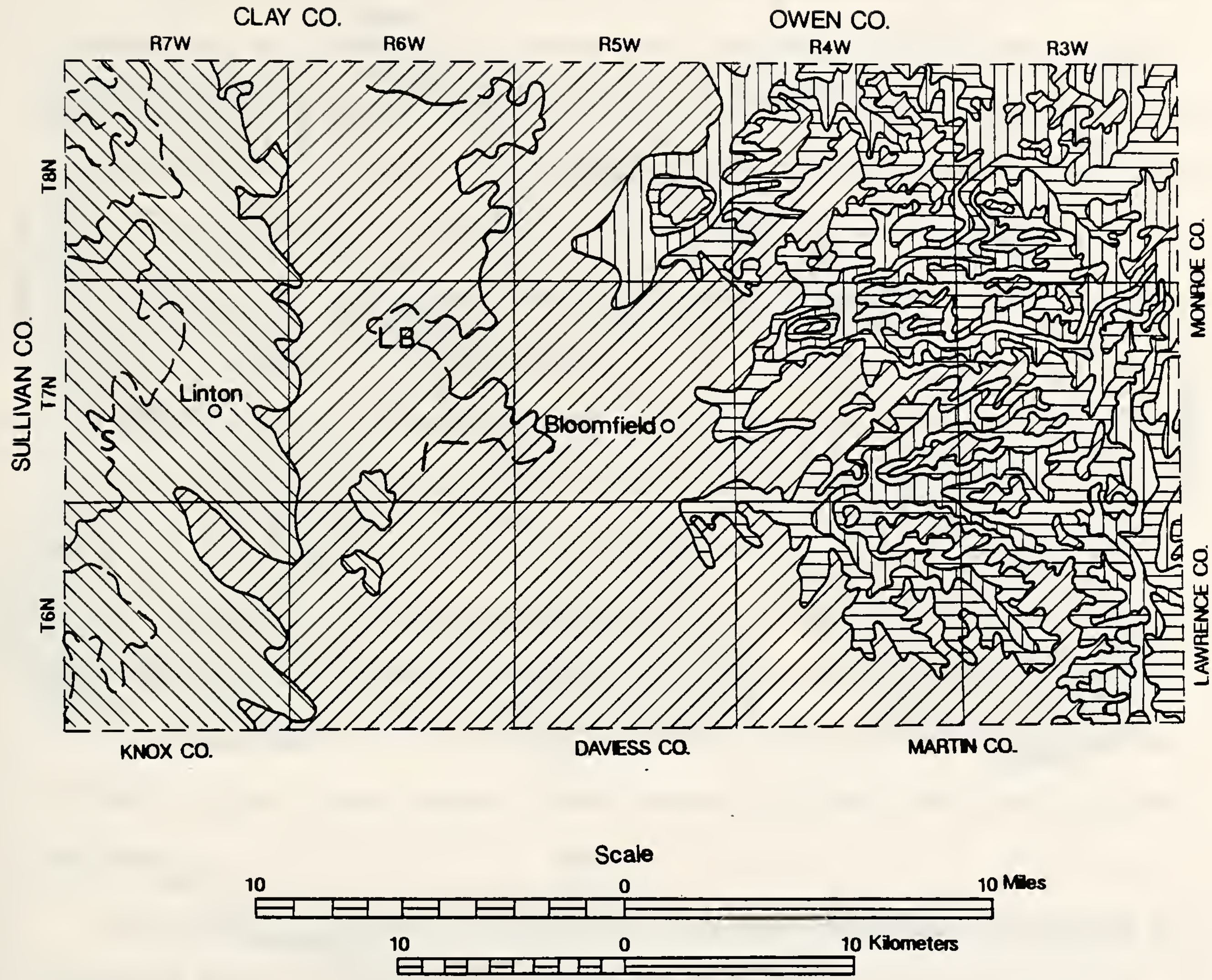
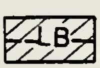


FIGURE 10. COLUMNAR SECTION SHOWING BEDROCK STRATIGRAPHY OF GREENE COUNTY (19).



EXPLANATION

Carbondale Group. Mostly shale and sandstone, also includes thin beds of limestone, clay, and coal. S, Springfied Coal Member.



Raccoon Creek Group. Mostly shale and sandstone; also includes thin beds of limestone, clay, and coal. LB, Lower Block Coal Member.


West Baden Group. Shale, sandstone, and micritic and skeletal limestone.

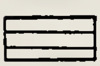

Blue River Group. Mostly micritic, skeletal, and oolitic limestone.

FIGURE 11. BEDROCK GEOLOGY OF GREENE COUNTY (26).

91

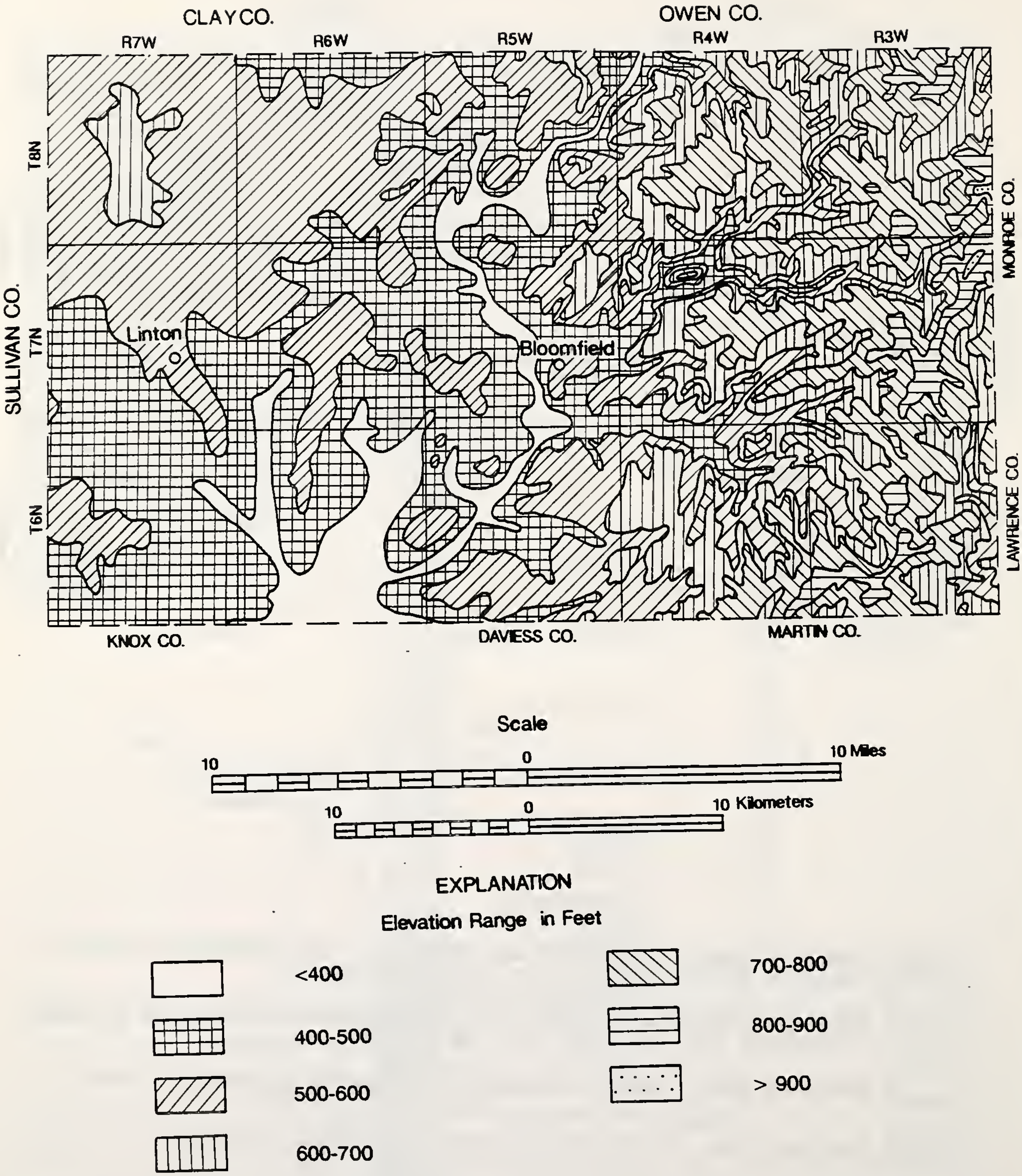


FIGURE 12. TOPOGRAPHY OF THE BEDROCK SURFACE IN GREENE COUNTY (18).

Remnants of these lake plains are shown on the engineering soils map as Illinoian age slackwater terraces. The largest area, known as the "American Bottoms," is a lacustrine plain lying between two of the main ridges of the region, and is perched approximately 100 feet above Beech Creek valley on the north and Clifty Creek valley on the south. It is underlain by a variable thickness of outwash sand and gravel. The present stream of Lost Creek has a poorly marked valley some 12 feet below the general level of the lake flat where the stream flows into an opening in the sandstone bluff (3).

Withdrawal of the Illinoian glacier marked the beginning of the Sangamon interglacial stage of erosion and weathering. During this time, the White and Eel Rivers were once again developed on the till plain above their buried valleys because of differential compaction of the glacial drift (23). Also, consequent valleys were developed on the glacial plain in the western portion of the county. The till was eventually removed to or nearly to the bedrock floors of the preglacial White and Eel drainage systems. Such widespread and deep erosion was probably the result of minor regional uplift or rebound of the earth's crust after the ice had retreated.

Following the Sangamon interglacial stage, Greene County was approached by continental glaciers of Wisconsinan age. The county was not covered by Wisconsinan ice; however, as the glaciers advanced upon the region from the north, the White and Eel River Valleys served as sluiceways for meltwaters from the ice front. The meltwaters carried great volumes of detritus derived from country rock and Illinoian till from the north. This detritus was dropped ahead of the ice in the White and Eel Valleys creating extensive valley train deposits (12).

At the maximum extension of the ice in Wisconsinan time, the terminus of the glacier was about 30 miles north of the northern border of Greene County as shown in Figure 5 (11).

As the ice withdrew to the north, melt waters continued to discharge down the major valleys in the county; however, the greater part of their detrital load was north of the Shelbyville terminal moraine (12). The surface of the maximum valley-fill in Wisconsinan time, when the ice sat at the Shelbyville moraine, is called the Shelbyville terrace. Remnants of the Shelbyville outwash terrace surface exist along the White and Eel Rivers near Worthington in northern Greene County and near Ilene in the southern part of the county.

The valley trains were built down the sluiceways of the White and Eel Rivers so rapidly that their tributary valleys were ponded, and an extensive system of lakes was formed. These lakes are represented by lacustrine (slackwater) plains whose levels coincide closely with the altitude of the valley train which occupied the adjacent sluiceway (12). Figure 13 is a block diagram that shows the general relation between these slackwater deposits, outwash deposits, and recent stream deposits (22).

Throughout Wisconsinan and Illinoian time in Greene County, winds have picked up sand and silt from the White and Wabash River valley trains and have deposited them on adjacent uplands, terrace surfaces, and lacustrine plains (24). The sand was blown relatively short distances, but the silt was deposited over a much larger area.

Sand dunes are developed throughout the length of the White River Valley and to a lesser extent along portions of the Eel River Valley. These sand areas cover outwash terraces, lacustrine surfaces, and upland bluffs. Nearly all the upland areas of the county are covered by a mantle of loess. The loess mantle generally ranges from a few inches to more than seven feet thick and is thinnest on steep areas where much of it has been removed by erosion (2).

In recent times, seasonal floods and erosion of the meandering White and Eel Rivers have resulted in their present wide flood plains and alluvial deposition. Also, their channels are locally shifting leaving many abandoned meanders and channel scars.

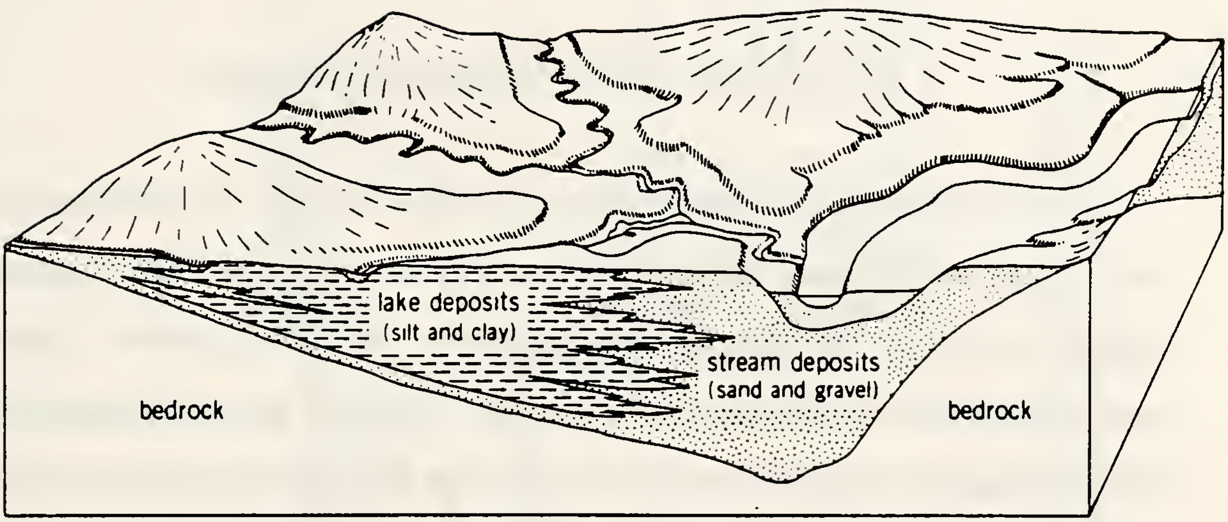


FIGURE 13. Block diagram showing relation of lake deposits to tributary valleys, glacial outwash (sand and gravel) in main valley, and associated stream deposits. Diagram does not show a specific place but incorporates many features typical of lake deposits and terraces that they form. Width of block about 10 miles; depth of block about 200 feet. (22).

Figure 14 is a cross-section showing the general geometry of the geologic materials in western Greene County (16). The approximate thickness of the unconsolidated deposits in the county is given in Figure 15 (21). The thickest deposits of unconsolidated materials, greater than 150 feet, are found in the southern White River Valley, while the thinnest, less than 50 feet, are located in the upland regions.

LANDFORM-PARENT MATERIAL REGIONS

The engineering soils in Greene County are derived both from unconsolidated materials and from the weathering of sandstone, shale, and limestone bedrock. These materials are classified according to parent material and landform in the following section. Eight parent material units are mapped in the county. They are: eolian drift, glacial drift, lacustrine drift, fluvial drift, glacial-fluvial drift, cumulose drift, bedrock, and mined land. The parent materials are further divided into individual landforms for discussion purposes.

Each landform-parent material region is characterized by its overall extent, surface morphology and character, and general soil profile. Soils are classified in the profile description using both the United States Department of Agriculture textural designation, i.e. silt loam, and the American Association of State Highway Officials (AASHTO) system, i.e. A-6. Also, the agricultural soils that form in each unit are given. The physical, chemical, and engineering index properties of these soils are presented in Appendices B and C. Boring numbers, which correlate to the classification test results given in Appendix A, are also stated for each soil unit.

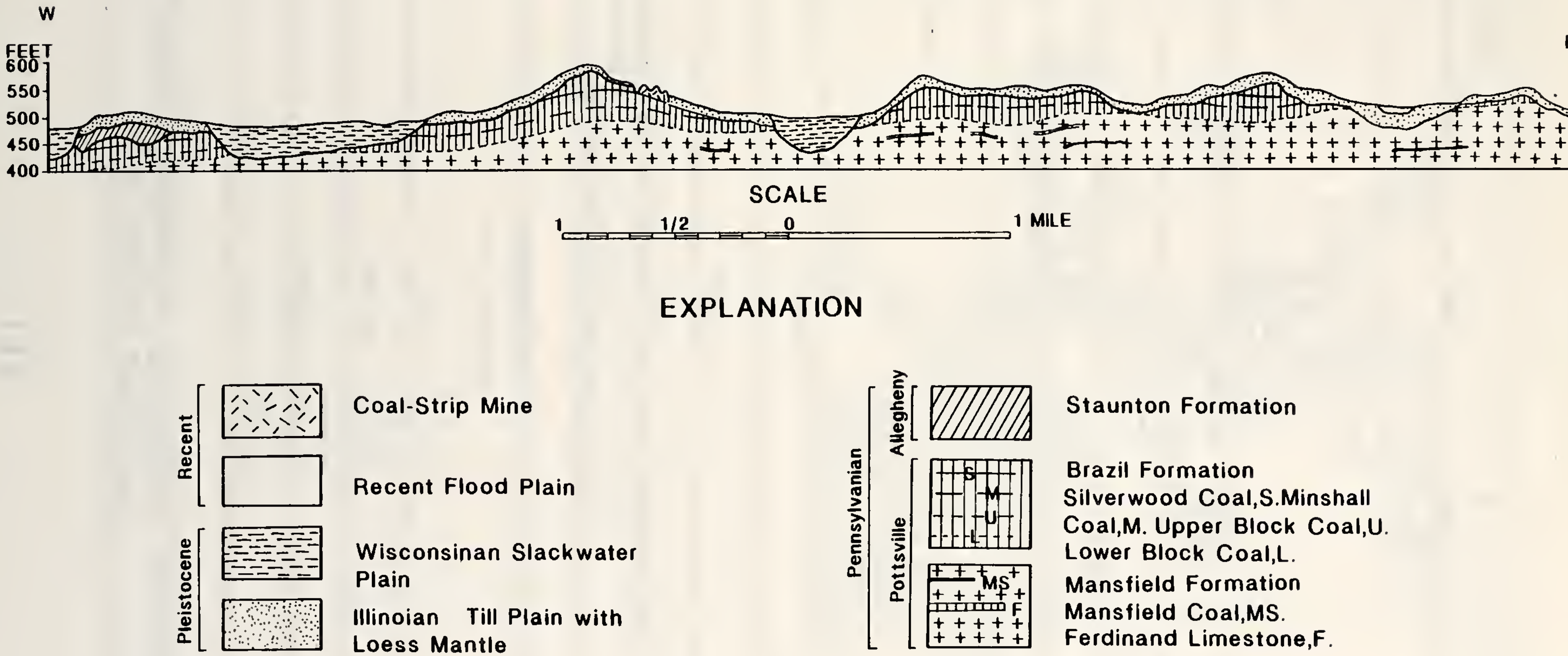


FIGURE 14. GENERALIZED GEOLOGIC CROSS—SECTION THROUGH A PORTION OF WESTERN GREENE COUNTY (16).

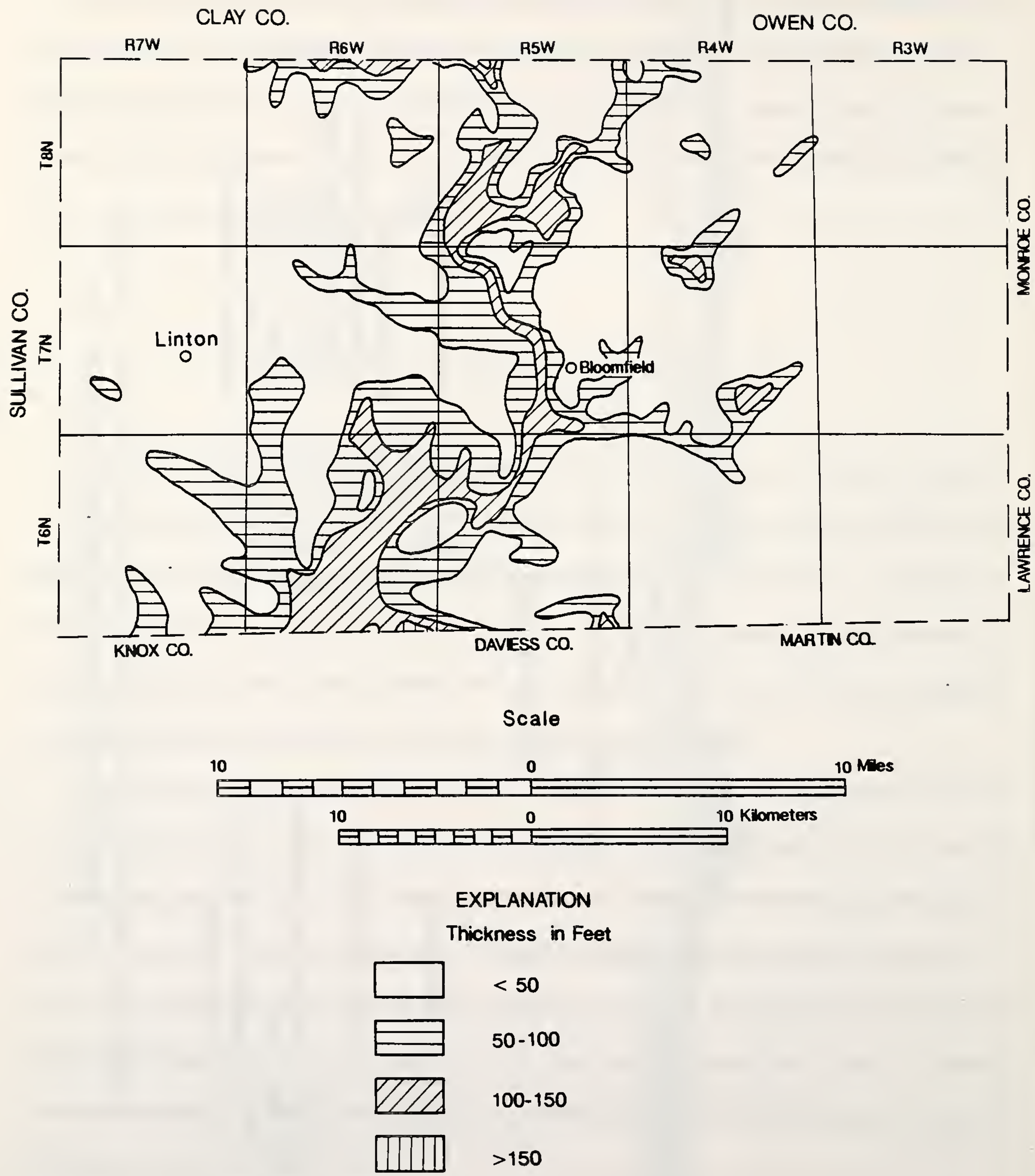


FIGURE 15. THICKNESS OF UNCONSOLIDATED DEPOSITS IN GREENE COUNTY (21).

Engineering considerations for each parent material region are also discussed. This section gives the investigator a general idea of the material behavior and possible problems encountered within each landform-parent material region.

EOLIAN DRIFT

Eolian (wind deposited) drift of Wisconsinan age mantles a large portion of Greene County. Loess deposits cover nearly all the upland areas in the county, while sand dunes are most prominant on the bluffs east of the White River and on outwash terraces and slackwater plains west of the river. In the upland locations, there is a fairly well-defined division between the sand and the loess; however, in some areas near their contact, a thin veneer of sand may extend over the loess.

Loess Plain

The loess mantle in Greene County generally ranges from a few inches to more than seven feet thick and is thinnest on steep eroded slopes (2). The loess was determined, by the author, not to be thick enough to be mapped as a distinct landform-parent material type. Instead, it is grouped and classified with the glacial drift and bedrock landforms, as "Illinoian Ground Moraine with Loess Mantle" and "Sandstone-Shale Bedrock with Loess Mantle" respectively, in later sections.

The thickness of loess deposits in Greene County is illustrated by Figure 16. This figure shows isothickness lines and measurement locations of total loess thickness, in inches, based on investigations by Fehrenbacher (24). Appendix F catalogues the location, thickness of the loess, and a description of the underlying material for each measurement point on Figure 16. These data show that the thickest deposits, of over 75 inches, are found adjacent to the White River Valley. The loess tends to decrease towards the east, however, some variation does exist.

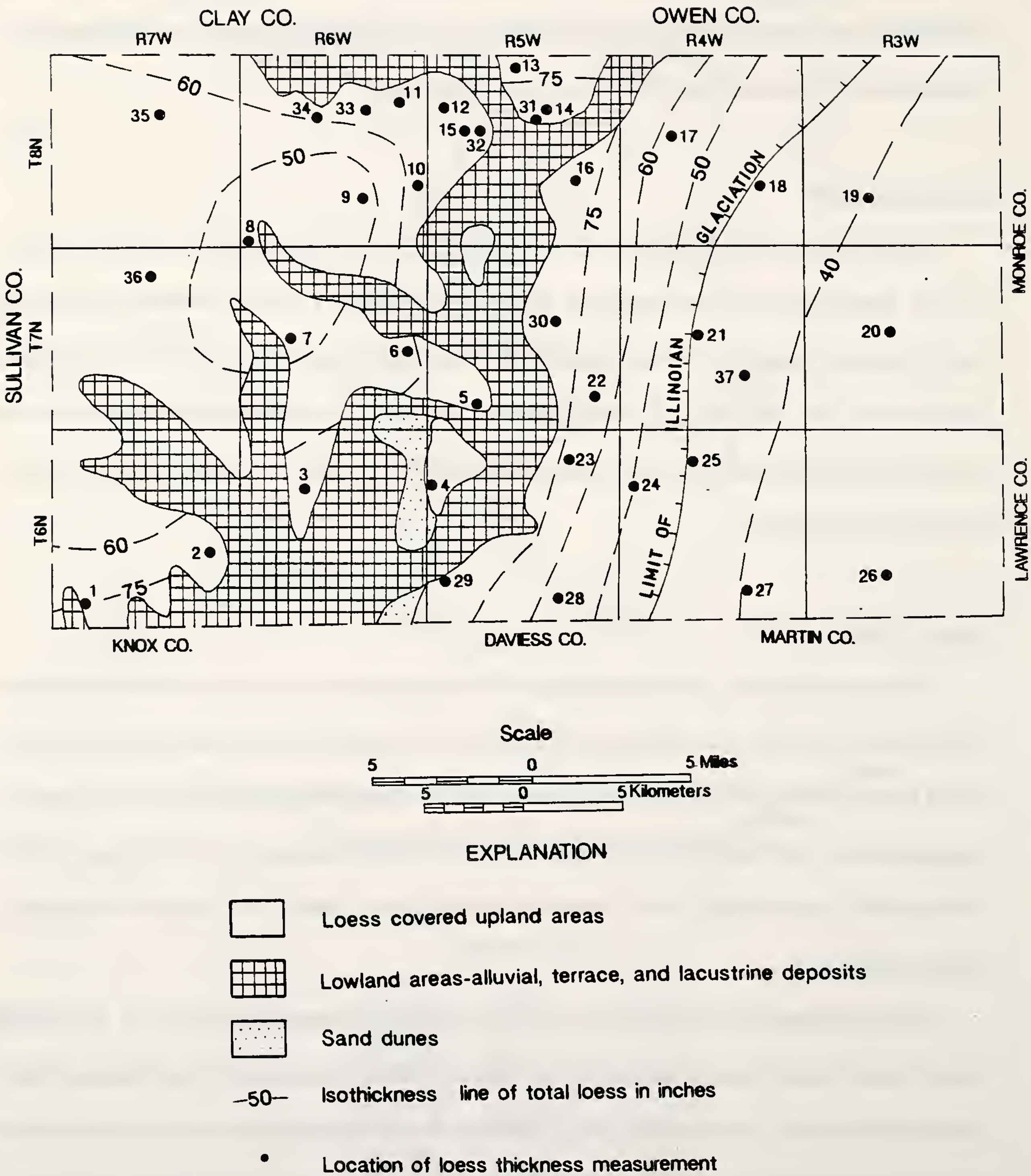


FIGURE 16. LOESS THICKNESS MAP OF GREENE COUNTY (24).

Loess appears to be thinnest in the eastern portion of the county, where loess, generally less than 40 inches thick, mantles sandstone and shale bedrock.

Sand Dunes

Sand dunes are formed on about four percent of Greene County (2). They are developed throughout the length of the White River Valley and to a lesser extent along portions of the Eel River Valley. These sand deposits are generally underlain by Wisconsinan age outwash and lacustrine materials in the bottom lands west of the White River, and by Illinoian till and sandstone-shale bedrock along the eastern and southern bluffs of the White and Eel Rivers respectively. However, in some locations they may mantle loess deposits. The upland dunes show variable relief ranging from about five to 50 feet high, while the dunes formed on the slackwater plains and outwash terraces are lower, usually less than 15 feet high.

The topography of the sand dunes varies from gently rolling hills to a hummocky surface consisting of small mounds and narrow ridges. Surface drainage systems are absent in these well drained sand regions. However, infiltration basins are observed in the inter-dune areas. These darker interdunal basins create a speckled appearance on the aerial photographs. A few short, steep gullies are sparsely developed along the edge of the dunes where the difference in elevation is great between the adjacent land. Also, gully development is commom at the sand dune-loess contact.

The composition of the sand dune material is predominantly fine, uniform, windblown sand. However, small amounts of silt and clay particles are mixed with the sand near the surface. Lateral and vertical variations in composition are also observed in these sand areas. The surface soils are usually fine sand (A-3) or loamy fine sand (A-2-4). The subsoil consists mainly of fine sand, sandy loam (A-4), and sandy clay loam (A-6). The underlying material is

most often fine sands and loamy fine sands that may be stratified at depth. Interdunal basins generally have a higher clay content in their subsoil. In some locations the water table is high and surface ponding is favorable. In these regions, the surface soils have a higher organic content.

The agricultural soils that form in sand dune areas are the Alvin, Ayrshire, Bloomfield, and Princeton series (2).

Engineering Considerations in Eolian Drift

The engineering considerations in deep loess, as well as those in the sand dunes areas, are discussed because of the depositional variation of loess in Greene County. At a given site location loess may be of significant thickness. For example, measurement location 15 in Fehrenbacher's data shows 125 inches of loess over Illinoian till.

Unweathered loess is poorly cohesive and has a high porosity and permeability (vertical > horizontal), while weathered loess is slightly plastic and less permeable. Loess is usually classified according to the Unified system as ML, ML-CL, or CL material.

At natural moisture contents loess has a relatively high strength, as well as low compressibility, because of partial cementation. However, upon wetting, the cementing softens and the loose structure often collapses, particularly when the soil is stressed by foundation loads. The result can be excessive settlement or bearing capacity failure. The potential for settlement has been related to natural dry density and moisture content in terms of Proctor density and moisture in Figure 17 (27).

Careful attention to grading and drainage can do much to prevent settlement or shear failure of loess soils. Stripping the natural vegetation leaves loess vulnerable to rainfall

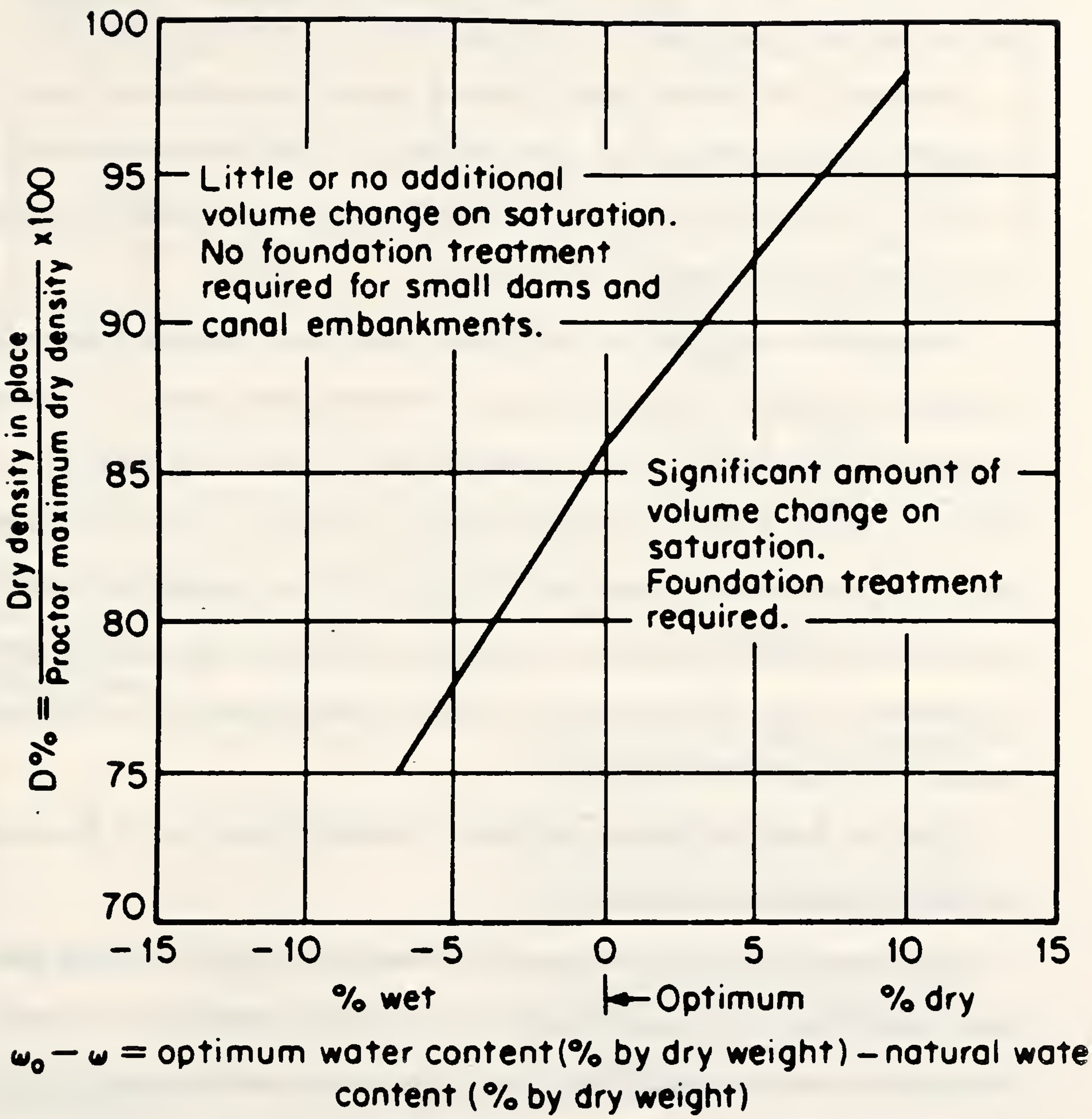


FIGURE 17. POTENTIAL FOR LOESS SETTLEMENT (27).

saturation and possible ground collapse. Site grading and drainage require planning to avoid the ponding of water, and utilities must be constructed so as to prevent leaks (28).

Prewetting these areas has been employed in some cases, but this could result in so soft a condition that the site is no longer usable. Precompaction of the loess by ramming the soil in narrow columns has also been used. Additional stability can be obtained using lime, lime fly ash, or a cement as a stabilizing agent (29).

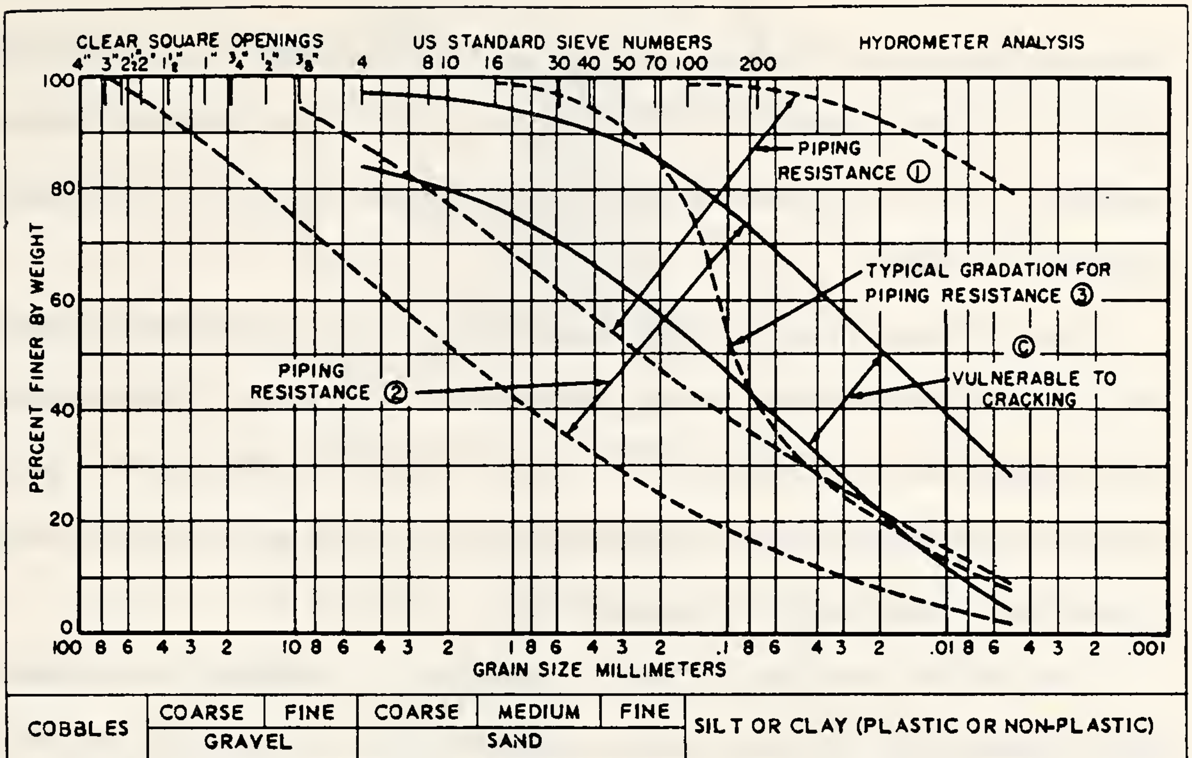
Embankment construction can be difficult in loess areas. When loess is dry, compaction is virtually impossible as the silty soils tend to blow away. Also, if placed in an embankment in an excessively wet condition, loess can become quick, suddenly losing strength and flowing. However, at proper moisture contents, slightly below optimum for maximum density, loess makes suitable compacted embankment fill (30); but it must be protected against piping erosion and possible cracking due to foundation settlement, especially for earth dam embankments. Figure 18 gives ratings for Unified classified materials according to their resistance to piping and cracking (32).

Loess can be subject to large capillarity. This results in heaving of foundations and pavements upon freezing (frost heave).

Loess naturally stands on a vertical slope, therefore, cut slopes are usually more stable when made vertical. Cut slopes other than vertical should be stabilized by vegetation, and a drainage ditch should be placed along the top of the slope to prevent wetting (30).

Sand dunes are generally noncohesive and loose. The porosity and permeability are moderate to high , and the water table is seasonably high in low lying areas. Dune sand is usually classified as SM, SP, or SP-SM material.

Dune sand is a good to excellent foundation and subgrade material. However, it may be difficult to compact because of its uniform gradation. It is poor practice to place foundations



Category	Material	Characteristics
Piping resistance:		
①	CL and CH with PI > 15, well graded SC with PI > 15.	Greatest resistance to piping, small and medium concentrated leaks will heal themselves. Embankment may fail as a result of slowly progressive piping caused by leak of about 1/2 cfs.
②	CL and ML with PI < 15, well graded SC and GC with 15 > PI > 7.	Intermediate resistance to piping. Safely resists saturation of lower portion of downstream slope indefinitely. May fail eventually as a result of erosion caused by a small concentrated leak or by progressive sloughing. If a large leak develops, piping causes failure in a short time.
③	SP and uniform SM and ML with PI < 7.	Least resistance to piping. Usually fails in a few years after first reservoir filling if seepage is able to break out on downstream slope. Small concentrated leak on downstream slope can cause failure in a short period of time. High density from compaction increases resistance significantly.
Cracking resistance:		
Ⓐ	CH with D_{50} < 0.02mm and PI > 20.	High postconstruction settlement, particularly if compacted dry. Has sufficient deformability to undergo large shear strains from differential settlement without cracking.
Ⓑ	GC, SC, SM, SP with D_{50} > 0.15mm.	Small postconstruction settlement. Little chance for cracking unless poorly compacted and large settlement is imposed on embankment by consolidation of the foundation.
Ⓒ	CL, ML and SM with PI < 20, 0.15 mm > D_{50} > 0.02 mm.	Medium to high postconstruction settlement and vulnerable to cracking. Should be compacted as wet as possible consistent with strength requirements.

FIGURE 18. RESISTANCE OF EARTH DAM EMBANKMENT MATERIALS TO PIPING AND CRACKING (32).

on sand deposits where the relative density is not at least 60 percent or to a density of about 90 percent or more of the maximum density possible (29). This dense state reduces the possibility of both load settlements and possible settlement damage due to equipment or earthquake vibrations.

The sand dunes in Greene County are permeable and yield some water; however, the water table fluccuates so that water supply is small and undependable. These deposits serve as infiltration areas for underlying outwash aquifers. Sanitary landfills should be avoided in these areas as drainage through these materials is rapid, and effluent is likely to contaminate groundwater in underlying or adjacent aquifers.

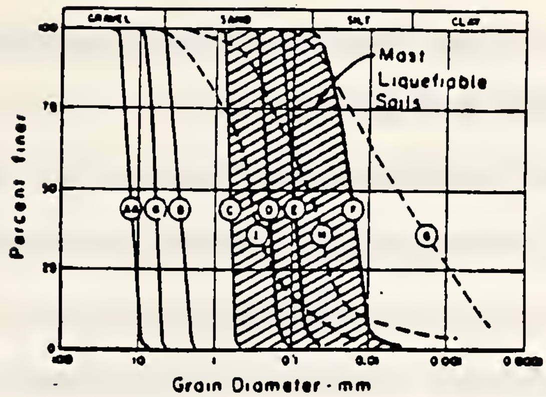
Loess and fine dune sand can be very susceptible to liquefaction when saturated and stressed dynamically. This is an important consideration as Greene County has historically been one of the most active seismic areas in the state (31). Figure 19 shows grain size distributions for the most liquefiable soils and the effect of this gradation on the cyclic strength of the materials.

GLACIAL DRIFT

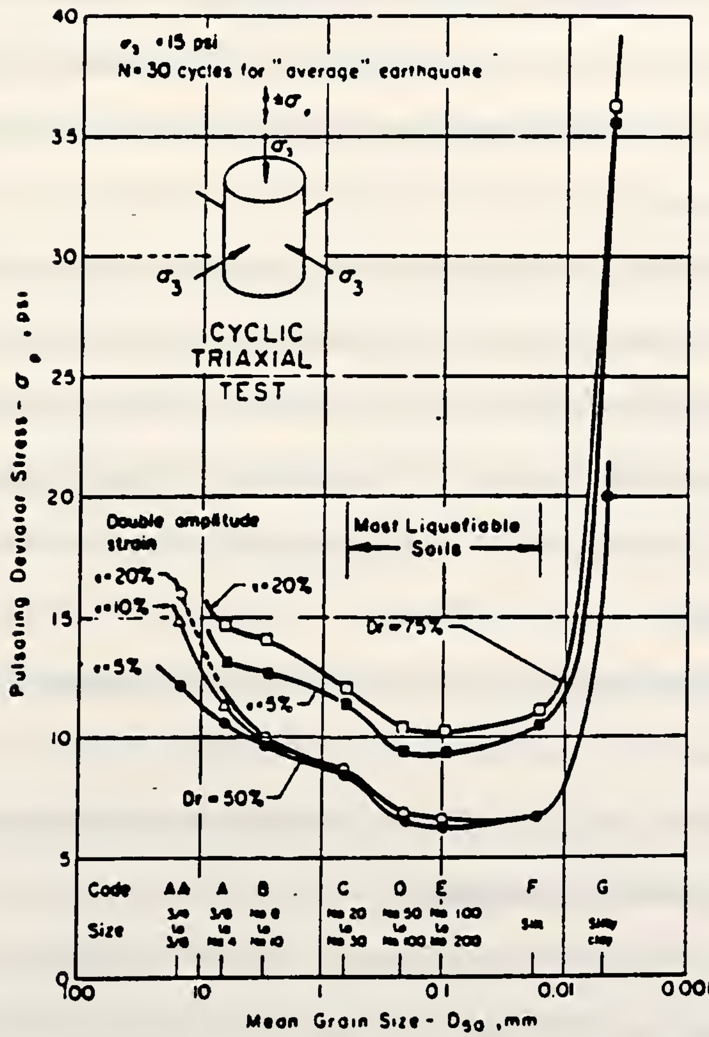
The western two-thirds of Greene County was covered by Illinoian glaciatation, whose eastern limit corresponds approximately with a line drawn through Newark and Scotland. The resulting till plain was then covered by a mantle of loess during Wisconsinan glaciation.

Illinoian Ground Moraine with Loess Mantle

This landform-parent material region makes up about 34 percent of the county. The Illinoian till in Greene County ranges from a few feet to more than 50 feet thick, and is generally thinner east of the White River, where bedrock is exposed on many side slopes (2). This region



a. GRAIN-SIZE DISTRIBUTIONS



b. EFFECT OF GRADATION ON CYCLIC STRENGTH

(From Lee and Fitton, 1968)

FIGURE 19. GRAIN—SIZE AND STRENGTH CHARACTERISTICS OF THE MOST LIQUEFIABLE SOILS (31).

exhibits a nearly level to strongly sloping surface. The more rolling the topography the shallower the depth to the underlying bedrock.

Broadly spaced dendritic drainage is found where drift is thick, leaving large interstream areas. Where drift is thin the dendritic pattern shows limited interstream area. Gullies are generally shallow and have a very low gradient, and tend to widen with length until bedrock is encountered. The typical white-fringed gullies found in Illinoian ground moraine areas in southern Indiana is not always present in this region because of the loess cover.

Unweathered till is a gray to greenish calcareous mixture of reworked soil particles and rock fragments densely compacted by glacial action. Lenses of clay, silt, sand, and gravel are common with peat and marl occuring less frequently. Large cobbles and boulders are infrequent but present (33).

The soils are formed in the mantle of loess and the underlying glacial till. In a typical profile, the surface soils consist mainly of silt loam (A-4, A-6), silty clay loam (A-6, A-7), and loam (A-4, A-6) about 12 to 24 inches thick. The subsoil, to a depth of about 72 inches, is firm silty clay loam, loam, and clay loam (A-6). The underlying material is generally silt loam, clay loam, loam, and sandy loam (A-4, A-6, A-2) with sandstone and shale fragments found near the bedrock contact.

The agricultural soils that form in these areas are the Ava, Cincinnati, Hickory, Shakamak, and Vigo series (2).

Boring numbers 16-20 are located in an area of thin Illinoian ground moraine adjacent to Richland Creek just east of Bloomfield.

Engineering Considerations in Glacial Drift

The Illinoian till in Greene County is classified as ML-MH to CL-CH material. Unweathered till (CL to ML) is moderately plastic (PI 10-20) with liquid limits varying between 25 and 40. Weathered till (CL to CH) is more plastic (PI 20-40) with liquid limits between 35 and 55 (2).

These materials are densely compacted, though uncemented, due to consolidation from their glacial deposition. This type of lodgement deposition results in a high density and a low void ratio. The till tends to be very impervious in the vertical direction and occasionally pervious horizontally via sand or gravel lenses (33).

Illinoian ground moraine serves as and excellent foundation material as it has been subjected to strong preconsolidation pressures during deposition. However, textural variability within a short distance should be anticipated. Occasionally layers or pockets of low strength materials are found at depth. In these situations differential movements can be expected. Locating these variations requires a detailed site investigation.

Cut slopes in Illinoian till are generally stable if properly drained. However, if wet, and soft clay layers are present in the till, slopes often are unstable and easily eroded.

Illinoian till deposits have fair to good workability and possess a high shear strength upon compaction (34). The unweathered portion of the till has good resistance to piping which combined with its other properties makes it an excellent embankment material. The weathered portion is typically silty, and in addition may have a significant mantle of loess, which makes it susceptible to erosion. This weathered material should be protected from erosion or only used in the embankment interior. Lenses of sand and gravel encountered in the till deposits can be used in the embankment unless the sand and gravel constitute a large portion of the deposit.

As a subgrade for county or state roads, the compacted till will provide adequate bearing support, but is subject to frost heave and pumping problems under concrete (35). Special base course material with good drainage is required.

Sanitary landfills may be sited in these areas provided the deposit is thick or where the underlying bedrock is relatively impermeable. Because of their low permeability and available cover material, Illinoian till areas offer the best protection against groundwater contamination in the county. However, a detailed exploration of a given site is essential to ensure that till is not fractured and that continuous seams of sand and gravel or permeable bedrock are not located at depth (36).

LACUSTRINE DRIFT

The areas of lacustrine drift parent material in Greene County include Illinoian age slackwater terraces, Wisconsinan age slackwater plains, and Recent oxbow deposits. These landforms are predominantly flat and exhibit very dark gray to gray photo tones. This dark tone is due to a high moisture content, poor drainage, and accumulation of clay. However, frequently low dunes and silt mounds are superimposed upon these lacustrine surfaces.

Illinoian Age Slackwater Terrace

There are three major areas of Illinoian slackwater deposition in Greene County: along Richland Creek near Hendricksville, along Doans Creek near Scotland, and in areas of the "American Bottom" along Plummer Creek. These deposits are remnants of marginal lakes that developed against the Illinoian ice front as a result of the damming by the ice of the westward and southwestward drainage in eastern Greene County (12).

These landforms generally exhibit a very level surface. Gullies are not uncommon, but are often widely spaced, and usually occur along the edge of the terraces.

In a typical profile, the surface soil is silt loam (A-4, A-6) eight to 12 inches thick. The subsoil, to a depth of 48 to 60 inches is firm silty clay loam (A-6, A-7), clay loam (A-6), or silt loam. The underlying material is stratified silty clay loam and silt loam. In the "American Bottom" region these soils are underlain by outwash sand and gravel. However, most of these deposits occur above bedrock or residual soils. These deposits may be erratic at depth, with granular or organic seams possible. Also, they may interfinger with outwash and alluvial deposits near their margins.

The agricultural soils that form in these areas are the Bartle, Evansville, Pekin, and Uniontown series (2).

Boring numbers 23-28 are located in Illinoian lacustrine drift, as thick as 60 feet deep, along Doans Creek east of Scotland. This deposit is underlain by sandstone and shale bedrock.

Wisconsinan Age Slackwater Plain

Wisconsinan age slackwater plains in Greene County are mainly confined to the wide tributary valleys of the White and Eel Rivers. These river valleys carried large volumes of meltwater from the waning Wisconsinan ice sheets, which eventually choked their valleys with sand and gravel, damming their tributary streams and creating an extensive system of lakes in western Greene County.

These extensive lake plains are nearly level, and therefore the deposits are thin in upstream branches and thicker downvalley. An exception to this appears to be the region just south of Worthington where these slackwater deposits form a thin mantle over outwash deposits adjacent to the White River, as evidenced by boring logs in this area. This relationship may also exist in the slackwater plains south of Fourmile Ditch near Lyons, where they are located adjacent to large outwash terraces.

Natural drainage is usually absent on these poorly drained flats, and extensive ditch systems are developed on their surfaces. Most slackwater plains in the county are cleared of trees and farmed.

In a typical profile, the surface and subsurface soils are silt loam (A-4, A-6), silty clay loam (A-6, A-7), silty clay (A-7), or clay (A-7) to a depth of 40 to 72 inches. The underlying material is mainly stratified clay and silty clay loam or stratified silt loam and silty clay loam. However, as mentioned above, in some locations the underlying material is sandy loam derived from outwash deposits. The deep slackwater deposits may be erratic at depth, with organic pockets, sand lenses, and gravel seams possible. Also, they may interfinger with outwash and alluvium at their margins.

The agricultural soils that form in these areas are the Booker, Henshaw, Evansville, Markland, McGary, Montgomery, Patton, Peoga, and Zipp series (2).

Boring numbers 74-76 are located in deep Wisconsinan age slackwater deposits south of Switz City. Boring numbers 8-15 illustrate thin slackwater deposits over outwash south of Worthington, and boring numbers 4-7 are found in slackwater deposits northeast of Lonetree in a tributary valley of the Eel River.

<u>Oxbow</u>

These deposits of lacustrine drift are confined to abandoned river meanders of the White and Eel Rivers. These deposits exihibit a very dark photo tone and are usually "half-moon" or "snake" shaped. Oxbows are very poorly drained and show no surface drainage features.

In a typical profile, the surface soil is generally silty clay (A-7) to a depth of 12 to 18 inches. These surface soils usually have a high organic content. The subsoil, to a depth of 48 to 60

inches, is clay loam (A-6) underlain by silty clay loam (A-6, A-7). However, fine sand (A-3) is encountered in many locations.

The main agricultural soil that forms in these areas is the Wilhite series (2).

Engineering Considerations in Lacustrine Drift

The lacustrine deposits in Greene County are principally classified as ML, CL, MH, or, CH material, otherwise described as lean to fat clay and silt. These deposits are moderately to highly plastic, with plasticity indices ranging from 20 to 42 and liquid limits varying from 35 to 65 (2). These lacustrine soils are very porous, but relatively impermeable. The water table is high as the result of strong capillarity, and their surfaces are subject to flooding.

The drainage of these soils is naturally very poor, and in a wet condition the plastic nature of the material makes it unsatisfactory for pavement subgrades because the high potential for shrink-swell. Also, the capillarity in these fine-grain deposits makes them subject to heave upon freezing. Roads constructed in these areas should use a suitable compacted fill that will insulate the pavement from the lake deposits (22).

Compaction is difficult in these materials. Close control of the moisture content must be maintained. The compacted fill is susceptible to pumping, frost heave, and sideslope problems. The compacted soil has a low permeability; however, it is not recommended for use in dikes, embankments, or drainage canals, because of its low erosion resistance. The material also should not be used for water retention structures where seepage is critical.

Cut slopes in these lacustrine deposits should be made with special attention as natural slopes in these materials are not reliable guides to permissible cut slope designs. Very poor drainage, together with a typically high water table and high water content (Figure 20), makes it impossible for the zone of saturation to adjust quickly to the new cut surface, so that slumping

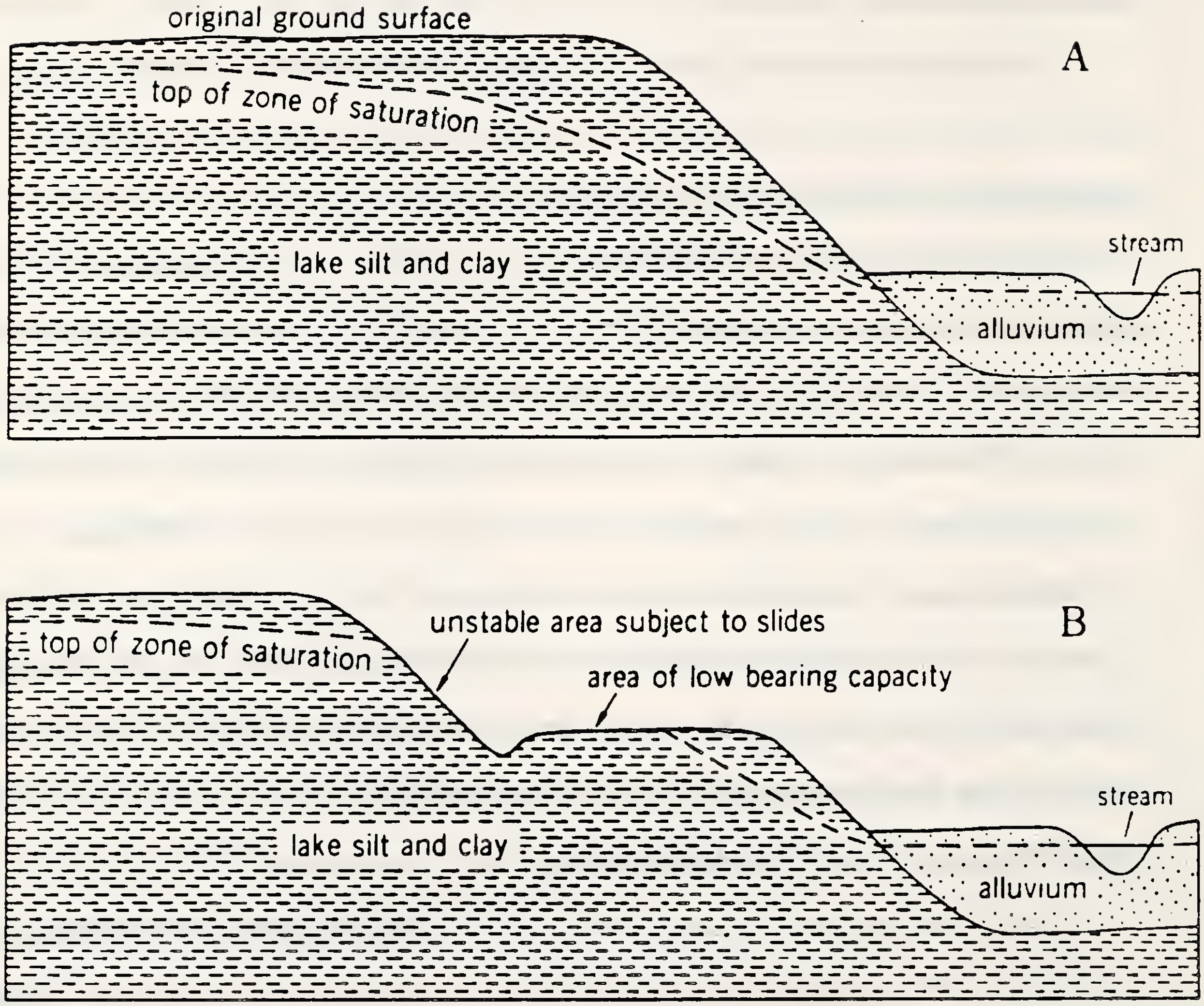


FIGURE 20. A, Cross section showing natural slope on lake silt and clay, and B, Same cross section showing new cut that exposes saturated, unstable material. In A, top of zone of saturation has become adjusted to this slope over a long period of time. Most rainfall runs off and top of zone of saturation fluctuates little. In B, internal drainage of lake silt and clay is so slow that slumping is likely before top of zone of saturation can achieve equilibrium with new ground surface (22).

in deep cuts is nearly inevitable. This is explained by the fact that natural slopes have drained shear strength parameters (effective cohesion and internal friction) resisting sliding while cut slopes have undrained shear strength parameters (cohesion only). Also, the slow permeability of the lacustrine deposits does not allow dissipation of shear induced porewater pressures. Cut design should therefore be based on an undrained shear analysis such as that shown on Figure 21 (32). The simplest solution is to design for a lower slope angle, which not only reduces forces at the toe of the slope, but also opens more area to capillary drying. Developing cuts in stages over a period of several months, to allow time for the water table to adjust, may also be used to minimize slumping of cut slopes in these regions (19). Because of the low permeability of this soil, drains would not be an effective means of reducing porewater pressures.

Lacustrine deposits in Greene County are normally consolidated; this means that the deposits have not been "preconsolidated" or stressed by loads greater than those exerted by the weight of the material itself. Placing a load of any kind, such as a building, dam, or highway fill, on these materials could result in consolidation of the deposit, accompanied by settlement of the structure. The amount of settlement is a function of the added load, thickness of the underying lacustrine drift, water content and clay content of the deposit, and time. Large differential settlements can be expected where loads are very unevenly distributed or where structures are founded partly on stable bedrock and partly on thick lacustrine material (22).

One solution to the settlement problem in these lacustrine soils is the use of a partially compensated foundation, where the soil is excavated to a depth such that the effective weight of the removed soil is nearly equal to the weight of the structure. Partial compensation is easily accomplished by the construction of a basement; however, the high water table in these areas may make this difficult. An appropriate design approach for large, heavy structures may be to

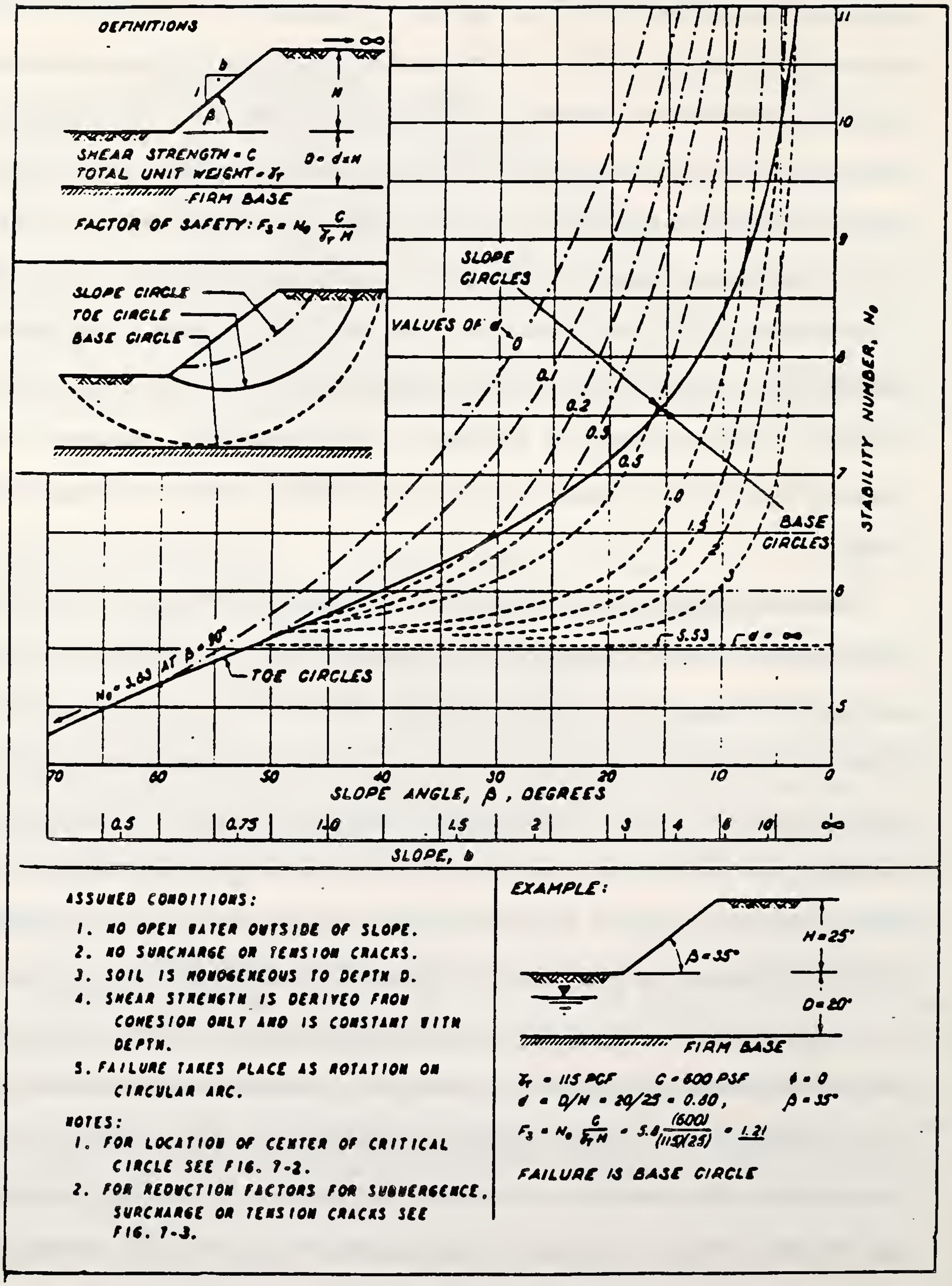


FIGURE 21. STABILITY ANALYSIS FOR SLOPES IN COHESIVE SOILS, ϕ=0 (32).

distribute the load widely with a slab or mat foundation. This method reduces contact pressures, therefore reducing settlements.

Water supply is a problem in many of these regions. Although these deposits contain a great amount of water, they are of such low permeability that water in them cannot be removed by pumping. Scattered lenses of saturated sand and gravel, in and at the base of these deposits, tend to be "quick" as a result of their high silt and clay content. These materials clog well screens and pumps, and at best the yield from these lenses is low (22).

The high water table, flood hazard, and nearly impermeable nature of these materials makes the use of septic tanks and associated tile fields impracticable. Where lacustrine drift is thick and protected from flooding, sanitary landfills may be feasible. Because water moves extremely slow through these deposits, contamination of nearby water bodies is unlikely, and the high water table is a problem mainly in its effect on access and excavation (36).

Oxbow deposits are unsuitable for most engineering considerations and should be avoided. They are subject to frequent flooding, possess a high water table, and are extremely compressible.

FLUVIAL DRIFT

The areas of fluvial drift parent material in Greene County include the wide flood plains of the White and Eel Rivers and their tributary flood plains located in the glaciated and residual uplands. These three alluvial types differ in composition and morphology, and therefore are separated for discussion purposes. Fluvial drift covers approximately 15 percent of Greene County.

White and Eel River Flood Plains

The wide flood plains of the White and Eel Rivers are characterized by nearly level topography and variable photo tones. The depth of these deposits is quite variable and they generally overlie glacial outwash or bedrock. The channels themselves are usually incised in valley train outwash; however, bedrock is exposed at some locations on the side and bottom of the channels. Anastomotic drainage patterns are also observed in both valleys.

In a typical profile, the surface soils consist mainly of silt loam (A-4, A-6), loam (A-4, A-6), or sandy loam (A-4, A-6, A-2). The subsoil is silt loam, silty clay loam (A-6, A-7), loam, or sandy loam. The underlying material is usually silt loam or stratified sandy loam, silt loam, and loam; however, outwash derived deposits of gravelly sand (A-1) or stratified gravelly sandy loam (A-2) and loam occur where alluvium is thin. Extreme variation in these deposits should be anticipated. Although coarse material is not plentiful in deep alluvium in either valley, sand and gravel lenses may be present. Also, some surface soils are highly organic and organic pockets can be found at depth.

The agricultural soils that form in these areas are the Armiesberg, Haymond, Newark, Nolin, and Wirt series (2).

Boring numbers 71-73 are located in the White River flood plain directly east of Worthington, where SR 157 crosses the White River. These borings show about 15 feet of alluvium overlying outwash sand and gravel. This alluvium/outwash contact is easily seen by the sharp increase in blow count values (SPT).

Minor landforms present in these flood plains include low dune forms, natural levees, and abandoned river courses in the form of meander scrolls, oxbows, and oxbow lakes. Natural levees are curvilinear ridges and swales, a few feet in magnitude, composed of overwash silt,

sand, and sometimes gravel. Point bars and sand bars are also found in and along the present channels of both the White and Eel Rivers.

Flood Plains in Illinoian Ground Moraine

The tributaries in the western glacial upland region are generally underfit for their flood plains, and have low gradients except in their upvalley branches. These flood plains are absent of mature flood plain features such as abandoned river courses, natural levees, and point bars. The poorly drained character of most of these tributary flood plains gives them a relatively dark photo tone.

In a typical profile, the surface soils are composed mainly of silt loam (A-4, A-6), with most of this material having been washed in from the surrounding loess covered uplands. The subsoil is silt loam, silty clay loam (A-6, A-7), loam (A-4, A-6), or sandy loam (A-4, A-6, A-2). The underlying material is generally silt loam, loam, or sandy loam. Variations may occur both vertically and laterally in these deposits. Granular lenses and organic pockets should be anticipated. Also, these materials may interfinger with adjacent slackwater deposits.

These alluvial soils are underlain by a variety of materials. In their upper courses, they may be found mantling loess; however, downvalley they are usually found over Illinoian till and sandstone-shale bedrock.

The agricultural soils that form in these areas are primarily the Bonnie, Cuba, Steff, and Stendal series (2).

Boring numbers 1-3 are located in flood plain deposits in the Illinoian Ground Moraine region near Linton. These borings show 10 to 15 feet of silty loam and silty clay loam overlying sandstone and shale bedrock.

Flood Plains in Sandstone-Shale Plateau

The tributaries in the eastern residual upland of Greene County generally have narrower flood plains than those in the glacial region. These flood plain surfaces are nearly level and generally absent of mature flood plain features.

Soils developed in these flood plains range from well to poorly drained. The poorly drained soils are found primarily in topographic low areas along the major stream valleys of Richland, Plummer, and Doans Creek. The extent of these poorly drained soils increases westward toward the Illinoian glacial boundary.

In a typical profile, the surface soils are composed mainly of silt loam (A-4, A-6). The underlying material is generally loam (A-4, A-6), silty clay loam (A-6, A-7), sandy loam (A-4, A-6, A-2), or silt loam. These soils often contain 20-50 percent sandstone fragments. Bedrock is usually found at a depth greater than five feet, and is predominantly composed of sandstones and shales; however, limestone forms the bedrock for many of these flood plains in the eastern most portion of the county.

The agricultural soils that form in these areas are primarily the Cuba, Haymond, Piankeshaw, Steff, and Stendal series (2).

Boring numbers 51-54, 55-59, 60-64, and 65-70 are found in flood plain deposits in the Sandsone-Shale Plateau region. Borings 51-54, located at CR 580 East over Richland Creek, show about 10 feet of alluvium over shale and limestone bedrock. Borings 55-57, at CR 540 East over Richland Creek, illustrate deep alluvium of greater than 40 feet, overlying shale; however, borings 58 and 59 at the same location show only about 15 feet of alluvium overlying shale and limestone. Borings 60-64, located at CR 225 North over Richland Creek, show 20 to greater than 50 feet of alluvial material underlain by sandstone. Borings 65-70, at SR 157 over Kelly Branch, are in about 30 feet of alluvium underlain by sandstone.

Engineering Considerations in Fluvial Drift

The fluvial deposits in Greene County are classified predominantly as CL, CL-ML, ML, SC, or SM-SC materials. These deposits are slightly to moderately plastic, with plasticity indices ranging from 5 to 25. Liquid limits generally vary between 20 and 45 (2).

The groundwater table is seasonably high in these areas and flooding is common. The hydraulic properties of these fluvial materials is generally poor. Permeability varies considerably from one location to another. These predominantly fine materials are also subject to high capillarity, high frost-heaving, and high liquefaction susceptibility (28). These conditions result in poor subgrade support for pavements. Therefore, roads should be constructed on raised, well-compacted granular fill material with adequate side ditches and culverts to reduce flood and frost damage (2). A geotextile might also be used to separate the poor subgrade and the granular base. This would eliminate mixing of the materials, which causes a reduction in the strength of the granular fill, and would reduce the amount of aggregate needed (37).

Foundation and excavation problems are associated with the generally saturated and non-uniform strength of these deposits. The soils have a moderate to high bearing capacity; however, differential settlements can occur when subsurface variations such as compressible organic pockets or loose sand lenses are present in the subsoil. The locations of such variations require a detailed site investigation. Scour of these materials should also be anticipated in any bridge foundation design. Excavations in these deposits may be difficult to maintain during high water periods, and are often subject to sidewall caving (28).

Embankment construction can be difficult in these areas as compactibility is a problem and requires careful moisture control. These fine fluvial sediments are also subject to piping and postconstruction settlements and associated cracking (see Figure 18).

Septic tanks and sanitary landfills are impracticable in these regions because of potential flooding and rapid effluent flow.

GLACIAL-FLUVIAL DRIFT

Glacial-fluvial drift in Greene County takes the form of outwash terraces of Wisconsinan age and outwash plains of Illinoian age. These materials are predominantly medium and fine sand with a lessor amount of gravel.

Wisconsinan Age Outwash Terrace

Outwash terraces of Wisconsinan age are located adjacent to the White River in Greene County. Their surface generally has a level to gently undulating topography and exhibits an overall light gray photo tone with dark specks. The specks are infiltration basins, which are common features in coarse-textured deposits with internal drainage. Although surface drainage is usually absent, old current markings are visible on many surfaces. The terraces are modified also by low sand dunes, and because these outwash deposits are very sandy, they are subject to wind erosion which causes blowouts in some areas.

In a typical profile, the surface soils generally consist of silt loam (A-4, A-6), loam (A-4, A-6), or sandy loam (A-4, A-6). The upper portion of the subsoil is silty clay loam (A-6, A-7), loam, clay loam (A-6), or sandy clay loam (A-6). The lower part of the subsoil is sandy loam or gravelly sandy loam (A-2). The underlying material is usually gravelly sand (A-1), sand (A-3), or stratified sand, sandy loam, and sandy clay loam.. However, the texture of outwash deposits in Greene County varies greatly from place to place.

The agricultural soils that form in these areas include the Ayrshire, Elston, and Waupecan series (2).

Illinoian Age Outwash Plain

Illinoian outwash plains in Greene County were formed by valley filling near the margin of the Illinoian glacier. Two remnant plains of this deposition are found in upland regions near Park in the central part of the county and near Scotland in the southcentral portion of the county. These well drained surfaces are nearly level to strongly sloping and are covered by about 40 to 50 inches of loess. In many locations the landform is highly eroded, with deep gullies usually found near its margins.

The soils are formed in the loess and the underlying glacial outwash. They show extreme variation in texture, which increases with depth. In a typical profile, the surface soils are generally silt loam (A-4, A-6), silty clay loam (A-6, A-7), or clay loam (A-6). The subsoils are silt loam, loam (A-4, A-6), sandy clay loam (A-6), or sandy loam (A-4, A-6). The underlying material is sand (A-3), gravelly sand (A-1), stratified sand and gravel (A-1), or stratified sandy clay loam and sand. Sandstone-shale bedrock is found in some areas as close as four feet from the surface.

The agricultural soils that form in these areas are the Chetwynd, Pike, and Parke series (2).

Engineering Considerations in Glacial-Fluvial Drift

Outwash materials are usually nonplastic; however, surface soils may be slightly plastic (PI 5-15). The porosity and permeability are generally high. These deposits are quite variable and classified as GP to SM material.

The water table is high in low lying areas and such areas are subject to flooding. In these locations excavations and cut slopes need to be properly drained to prevent collapse.

Wisconsinan outwash surfaces are essentially nonsusceptible to frost heave, liquefaction, or piping. However, the potential increases where surface material fineness increases.

Illinoian surfaces, on the other hand, are very susceptible to these problems because of their loess mantle.

Bearing capacity is good to excellent and settlements are generally immediate and low in magnitude. However, susceptibility to densification by vibration can be high. Also, slopes are very susceptible to erosion, especially in the case of the Illinoian age deposits.

Outwash deposits are an important source of sand and gravel in Greene County. They are also important aquifers, as discussed previously. The high permeability of these deposits makes septic tanks and sanitary landfills impracticable as drainage is rapid and leachate is likey to contaminate groundwater.

CUMULOSE DRIFT

Cumulose drift takes the form of peat and muck deposits in Greene County. These two areas are found southeast of Lyons and occur over outwash deposits.

Peat and Muck Basin Deposits

These basin deposits exhibit flat topography, a very dark photo tone, and no surface drainage. In a typical profile the surface layer, to a depth of 15-24 inches, is black muck (A-8) containing approximately 5-10 percent fibers. The subsoil is sedimentary peat (A-8) which contains about 30 percent fibers. The underlying material can be sandy loam (A-4, A-6) or sand (A-3) derived from the underlying outwash; however, it is usually also sedimentary peat containing many white shell fragments (2).

The agricultural soil that forms in these areas is the Muskego muck series (2).

Engineering Considerations in Cumulose Drift

Cumulose drift is characterized by very high organic contents, low densities, very high natural water contents, a loss in mass on ignition, and substantial shrinkage upon drying. Peat and muck in their natural state generally have a very high permeability; however, as the material is compressed, the permeability is greatly reduced (38).

Two characteristics associated with peats and mucks make them undesirable as foundation materials for buildings and embankments. First, these materials compress excessively when subjected to an applied load. A large portion of this compression is a result of relatively high amounts of secondary compression. These deformations occur over a long period of time, which compounds the problem. Also, these deposits possess low preconsolidation pressures; therefore, a large compression response is likey even at low stress levels. Secondly, peats and mucks are characterized by very low shear strengths and consequently very low bearing capacities (38).

These materials should be avoided in construction; however, if this is not possible, shallow deposits should be removed and replaced by a more desirable material. If the deposits of peat and muck must be used as a foundation material, the mechanical properties can be greatly improved by preloading the material with a surcharge. Preloading would improve the engineering properties in two ways. First, the expected settlements would be accelerated such that when the surcharge is removed the settlements under the design load would be drastically reduced; and secondly, consolidating the peat and muck would greatly increase their shear strength (38).

These cumulose deposits are usually highly acidic, and therefore are very corrosive to steel and concrete.

BEDROCK LANDFORMS

Approximately 30 percent of Greene County is covered by residual soils developed over sandstone, shale, and limestone bedrock. The landform-parent material units mapped in this region include Sandstone-Shale Plateau with Loess Mantle, Limestone Plateau, and Limestone Bench.

Sandstone-Shale Plateau with Loess Mantle

Most of the eastern one-third of Greene County is classified as Sandstone-Shale Plateau with Loess Mantle. The topography of this region is characterized by moderate to steep slopes and level upland areas. Many areas show well defined slope breaks, resulting from the interbedding of hard sandstone and soft shale. Local relief is commonly over 100 feet. Most areas are deeply dissected by small and large streams bordered by narrow flood plains. The ruggedness of this terrain is evidenced by the irregular road alignment shown on the airphotos.

These well drained soils are formed in the mantle of loess and the underlying sandstone and shale residuum. In a typical profile, the surface soils consist mainly of silt loam (A-4, A-6). The subsoil is generally silty clay loam (A-6, A-7), silty clay (A-7), or loam (A-4, A-6). The silty clays are usually found over shale bedrock and the loamy soils over the sandstone bedrock. These soils often contain weathered sandstone and shale fragments which increase in frequency and size with depth. The loess thickness is typically 12 to 48 inches and the depth to bedrock 20 to 80 inches. The soils developed on the steeper portions of the valley sideslopes are generally shallow, and contain more rock fragments than those of adjacent uplands.

The agricultural soils that form in these areas are the Berks, Ebal, Gilpin, Wellston, and Zanesville series (2).

Limestone Plateau

Areas mapped as Limestone Plateau occur along the eastern edge of Greene County adjacent to Richland Creek near Hendricksville and along Indian Creek east of Owensburg. The topography is moderately to strongly sloping. Bowl-shaped sinkholes occur in well-drained upland regions where limestone bedrock is within a depth of 20 to 40 inches from the surface. In some areas, the sides of the sinkholes are steep and severely eroded.

In a typical profile, the surface soil is silt loam (A-4, A-6) six to 24 inches thick. The subsoil is generally 20 to 36 inches thick. The upper part is silty clay loam (A-6, A-7) with the underlying soil being silty clay (A-7) or clay (A-7). These soils often contain limestone and chert fragments. The depth to limestone bedrock ranges from 20 to 60 inches. However, limestone outcrops on many hillsides.

The agricultural soils that form in these areas are the Hagerstown and Wellston series (2).

Boring numbers 45-50 are located in the Limestone Plateau region, adjacent to Illinoian slackwater deposits, near Hendricksville. These borings show about 10 feet of silty clay and thin shale beds above limestone bedrock.

Limestone Bench

Two small areas were mapped as Limestone Bench. These are found along Little Indian Creek south of Hobbieville near the eastern edge of Greene County. The benches exhibit level to slightly undulating topography, and their surfaces show scattered sinkhole development. This landform, capped with alluvial materials as well as residual soils, is subject to frequent flood erosion.

In a typical profile, the surface soil is silt loam (A-4, A-6) six to 24 inches thick. The subsoil to a depth of 12 to 54 inches is silty clay loam (A-6, A-7). The underlying material is

generally silty clay (A-7). The depth to limestone bedrock is from 40 to 72 inches. The contact between rock and soil is usually abrupt with little or no rock fragments in the profile (2).

The agricultural soil that forms in these areas is the Hagerstown series (2).

Engineering Considerations in Bedrock Landform Regions

Many engineering problems are encountered in the interbedded sandstone and shale regions in Greene County. The rugged topography, complexity of the geology, and variable depth to bedrock present serious problems when planning cut and fill requirements for transportation routes.

Shale rock presents a unique challenge when used as an embankment material. Problems arise when over time the shale weathers into a soil-like material. Voids in the once mechanically strong material subsequently collapse giving rise to untolerable settlements and embankment slope instabilities. Slake durability and compaction degradation are commom tests used to determine long term degradation of shale due to weathering. Also, because of the silty loess mantle and its variable thickness, those problems associated with loess presented earlier in this report need to be considered (i.e. frost heave, pumping, and piping).

The residual soils and rock formations in the sandstone-shale region provide adequate foundation support for light to moderately loaded structures. If bedrock is used for bearing support, it should be protected from weathering, as the shales, upon post construction saturation, slake and lose shear strength. However, bedrock will not be susceptible to slaking if it remains below the water table. The shallow depth to bedrock usually eliminates the need for deep excavations requiring bracing.

Slope instability in the interbedded sandstone and shale region is moderate to high. This is attributed to the seepage due to the layering and differential weathering of the

sandstone-shale units. The residual soils, as thick as 10 feet, are susceptible to sliding along the planar rock interface. Typically, the slope is initially weakened by removal of the toe (maintenance errror or by construction activity), and then the slope fails upon saturation after heavy rainfall.

Another possible slope instability in the sandstone-shale region is in the form of wedge failures. This is due mainly to the intersection of bedding planes and joint systems in the massive Mansfield sandstone, which is the cap rock in much of the central portion of this region.

Landslide problems have occurred along SR 58 west of Owensburg (52) in Greene County. In this area, shale residuum has slid northward along the bedrock surface. Several triggering mechanisms were postulated by an Indiana Department of Highways investigation. Knowledge of coal mining under the landslide area and discovery of high angle joints in the shale would indicate the possibility of the slide being triggered by an underground coal mine collapse. Or possibly just the consequential change in seepage patterns which occur with the mining of coal, may have softened the shale enough to cause slippage. Finally, the stream bank located to the north of the landslide area shows signs of undercutting erosion. This may have caused sufficient loss of toe support to have triggered the landslide.

Serious engineering problems are encountered in the limestone regions. Irregular weathering of the bedrock surface presents difficulties when large excavations or deep foundations are required. Planning of cut and fill operations for transportation routes is also difficult.

Bearing capacity of unweathered limestone is good; however, joints are closely spaced and often enlarge by solution weathering. Sinkholes, caves, and underground drainage should also be anticipated. Construction of highway embankments or foundations requires the repair of sinkholes to minimize the potential of future collapse. However, since sinkholes often drain

large areas, and are often interconnected through subsurface channels, alteration of the drainage may adversely effect surrounding areas. It is important that sufficient drainage be maintained whenever an existing sinkhole is filled. Special construction techniques are often required.

The plastic clay residuum in limestone regions is not a poor engineering material in its natural state, since it generally has a relatively high permeability for a clay, because of its internal particle structure. However, reworking (compaction) of these materials destroys the fabric and decreases the permeability. Pavement pumping and poor workability make this clayey residual soil a poor subgrade material. If this residual soil is relatively deep over sloping bedrock, slope instability may arise upon excavation at the toe. This loss of toe support together with saturation and excess pore pressures caused by heavy rainfall creates a critical stability condition.

Septic tank tile fields do not function well because the residual soil is nearly impermeable; where the soil is thin, effluent could move rapidly through open joints, contaminating groundwater. Sanitary landfills are impracticable except where soil is thick.

MINED LAND

Approximately five percent of the surface area of Greene County has been modified by mining activities. Coal-strip mines are found throughout the western part of the county, and several gravel pits are located adjacent to the White River.

Coal-Strip Mines

Coal-strip mines are a prominant landform in the western part of Greene County. These areas vary in shape and are generally 500 to 3,000 acres in size (2). The largest portion of these areas consists of narrow, elongated mounds of spoil created from the area mining technique

usually employed in southwestern Indiana (Figure 22). The spoil material is a mixture of shale soil, glacial till, coal, and sandstone fragments. At many older sites, these rock fragments have broken down to sand, silt, and clay particles (40). The shale is especially prone to degradation over time. Also included in the mapping unit are uneven piles of carbonaceous shale, low grade coal, and waste rock. In some areas, the mine refuse was shaped and smoothed after mining. However, usually only peaks were smoothed leaving elongated pits (Figure 22) that mostly contain water. The sides of many pits are steep, and large sandstone and shale fragments are exposed at the surface. In some areas these pits were used for settling ponds and contain a slurry mixture of coal, pyrite, and shale. These materials, termed tailings, are a byproduct of the coal washing and separation process (40). The sites also contain abandoned mine haul roads that consist mainly of extremely acidic carbonaceous shale and other mining refuse. Surface runoff in these regions is very rapid and gully development is great.

In a typical profile the surface soil, to a depth of six to 18 inches, is generally shaly silt loam, clay loam, or loam containing about 10 percent shale and sandstone fragments and some till pebbles. The subsoil, to a depth of 18 to 60 inches, is extremely shaly silty clay loam, silt loam, or clay loam containing about 50 percent shale fragments, 15 percent sandstone fragments, coal fragments, and till pebbles. The underlying material is usually silt loam or clay loam containing more and larger fragments of shale, sandstone, and coal. However, extreme variations should be anticipated. Bedrock is generally found at a depth greater than five feet (2).

The agricultural soil that predominantly forms in these areas is the Fairpoint series (2).

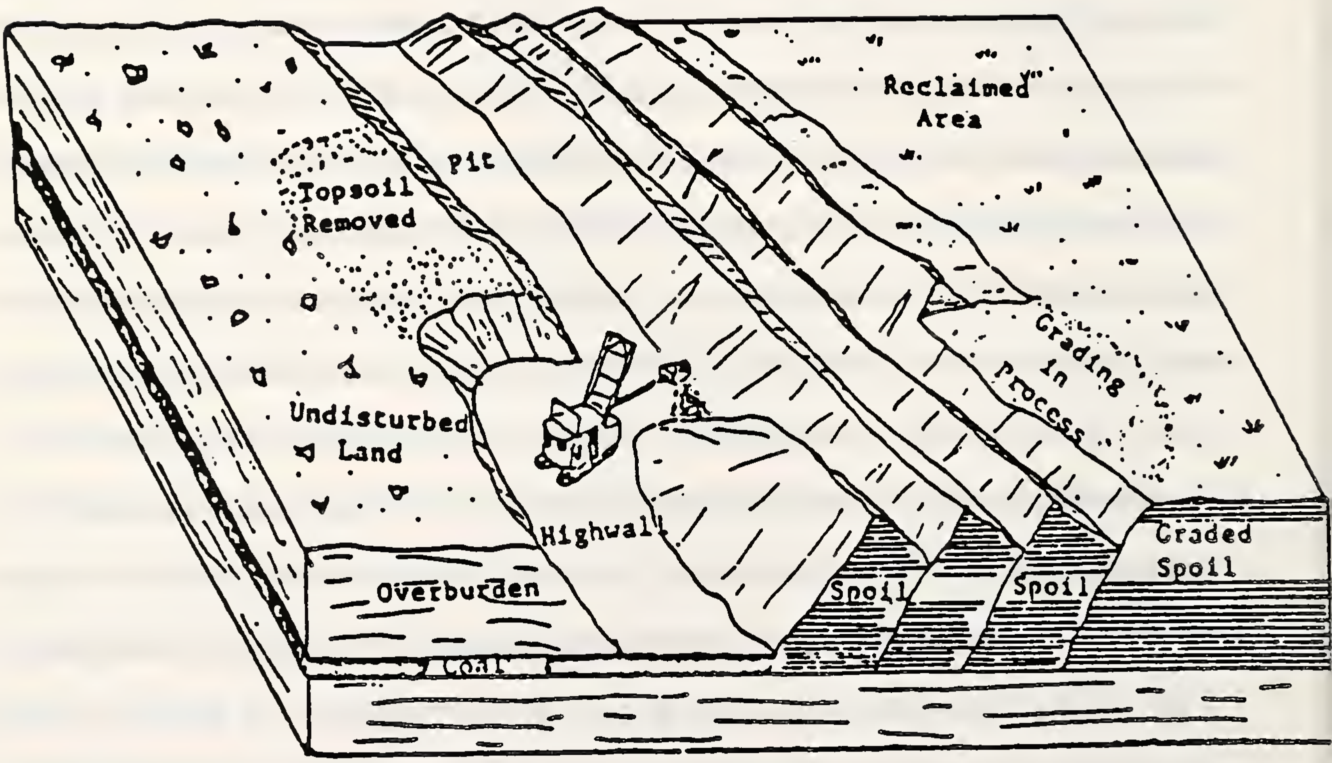


FIGURE 22. SCHEMATIC DIAGRAM OF AREA MINING TECHNIQUE (39).

Gravel Pits

Gravel pits in Greene County are found along the White River near Elliston and Bloomfield. These areas range from 10 to 100 acres in size (2). Most sites contain water filled pits. The materials consist mainly of sand and gravel separated out during gravel mining operations. This material is either found in mounds or has been graded.

Engineering Considerations in Mined Land

The materials in coal-strip mine areas are quite variable and in some places unknown. The worked-over spoil is generally slightly to moderately plastic (PI 5-25) and has a relatively low permeability. The tailings deposits tend to have a higher natural moisture content and higher permeability than the spoil (40); however, the permeability is quite variable and can decrease dramatically with depth.

Foundations and roads should be designed to compensate for large differential settlements, which should be expected in this variably compacted and fragmented material. The surface soils also have a high potential for piping, frost heave, and shrink-swell. The material is very corrosive to steel and concrete.

Sanitary landfills are possible in old stripped areas and active pits. If the predominant rock-type underlying the site is shale and no major aquifers exist beneath the site, refuse could be placed in existing trenches and final surfaces raised to enhance surface runoff. Also, the presence of a continuous layer of underclay could provide an additional barrier to downward movement of any leachate. And in many cases, effluent from the spoil banks is already contaminated with iron and sulfate leached from minerals in the soil. However, extreme care must be taken in planning such landfills (36). Gravel pits should be avoided in planning sanitary landfills because of their high permeability and potential for polluting shallow water supplies.

Surface mining and reclamation have affected surface-water quality in much of southwestern Indiana, especially in the coal-mining areas. Because of the oxidation and the weathering of pyrite and marcasite exposed in mining operations, drainage in many old mining areas has an acidic pH (> 7). In Indiana, many of these areas were mined before the passage of the Indiana Reclamation Law of 1968 (Indiana Code 13-46), which mandates that spoil piles be graded and cover vegetation be established. Although acid mine drainage has been reduced by current mining operations as a result of the preferential burial of pyrite, acidic drainage from old mines continues to be a water-quality problem (9). Sulfates are considered the best indicator of acid mine drainage, and should not exceed 250 milligrams per liter in drinking water (40).

Acid mine drainage is not the only water quality problem. Concentrations of many dissolved and suspended constituents, including iron and aluminum, are higher in both old and new mining areas than in natural water. Also, erosion from unreclaimed areas of old mines or unvegetated areas of new mines can substantially increase sediment loads in surrounding streams (9).

Underground mines and potential subsidence are also a source of concern in Greene County. Figure 23 shows numerous underground coal mines in the western portion of the county. Figure 24 illustrates areas with recognizable subsidence south of Linton (41).

Subsidence is indicated by the formation of sinkholes, ponds and troughs, alteration of the flow of groundwater, and damage to man-made structures. However, the problem of recognizing certain types of damage from mine subsidence is difficult because of its similarity to damage created by other causes. In many areas, damage from poor construction, freeze-thaw cycles, differential settlement, and subsidence due to withdrawal of groundwater cannot be differentiated from damage due to mine subsidence (41).

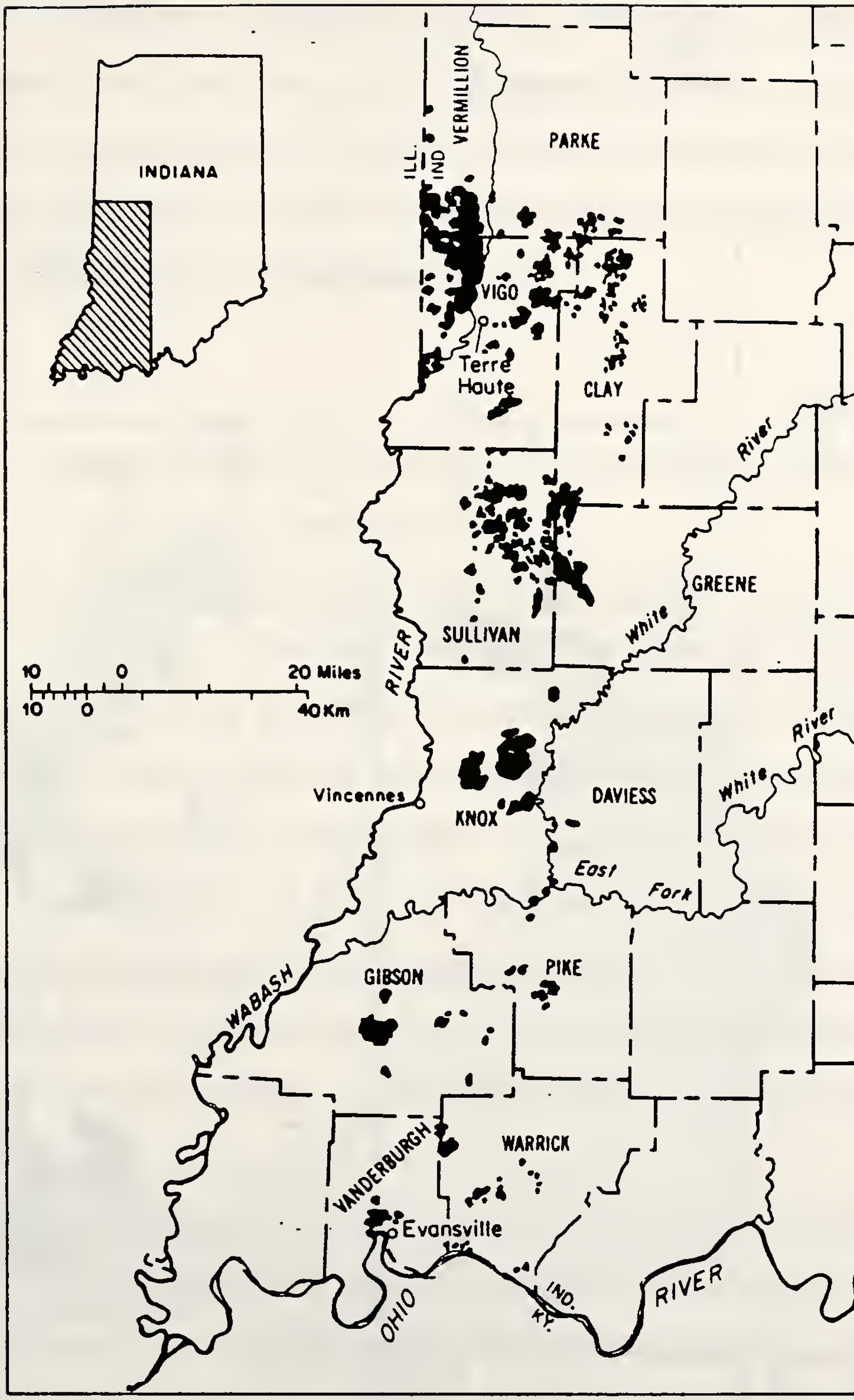


FIGURE 23. MAJOR UNDERGROUND COAL MINES IN SOUTHWESTERN INDIANA (41).

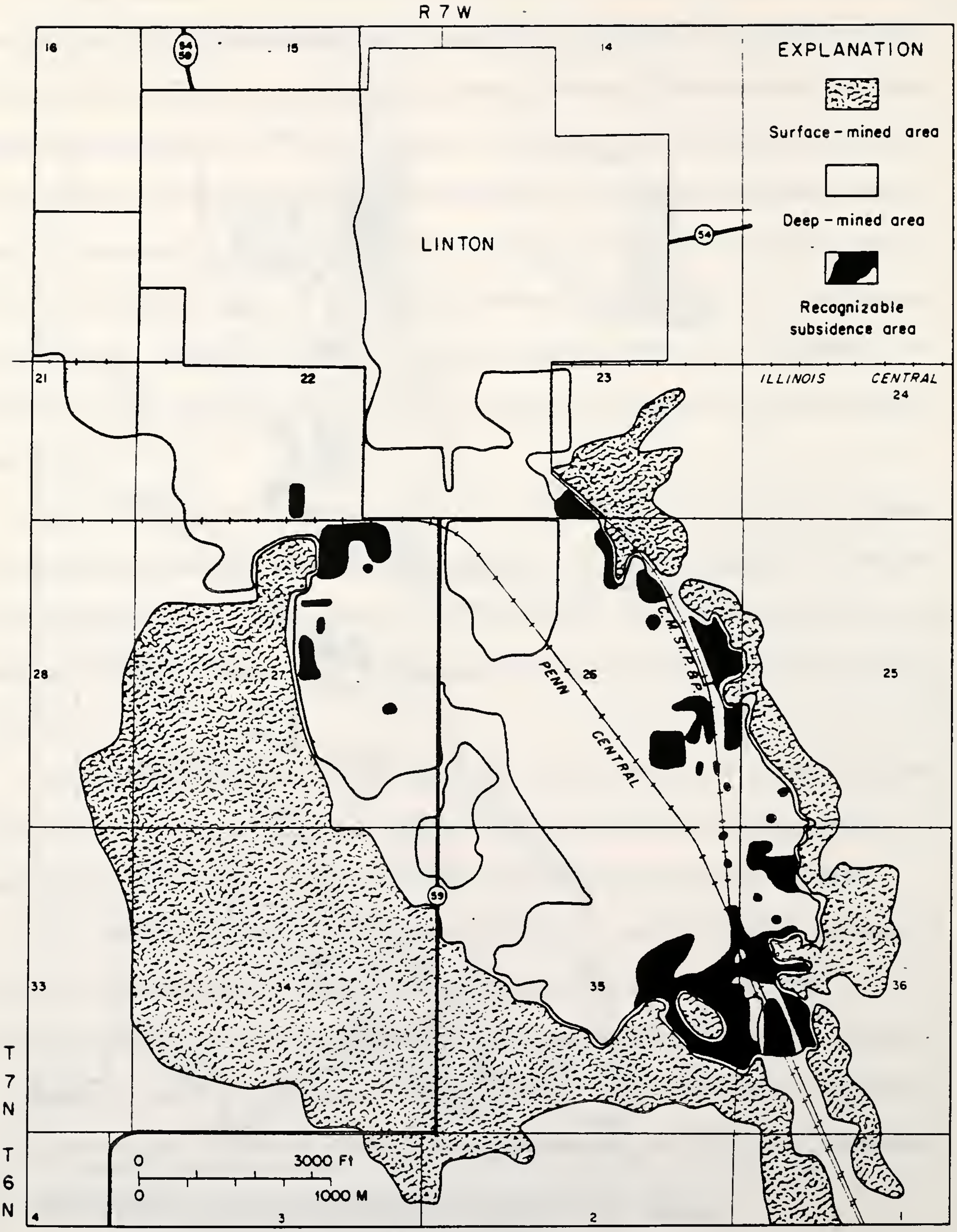


FIGURE 24. AREAS WITH RECOGNIZABLE SUBSIDENCE SOUTH OF LINTON (41).

If large structures are being planned and doubt exists concerning the extent of undermining, a drilling program is necessary to determine if a mine is present. The proper spacing of drill holes is critical for proper evaluation. Drilling must take into account possible unmined pillars of coal. If a prospective building site is known to be undermined, backfilling the mined-out space or using special foundation construction techniques should be employed to minimize any damage arising from future subsidence (41).

SUMMARY OF ENGINEERING CONSIDERATIONS IN GREENE COUNTY

A summary of engineering considerations for each landform-parent material region in Greene County is given in Table 5. This rating system is particularly useful for soil engineers inexperienced with the geotechnical characteristics of the soils in the county. This approach is based upon work by Sisiliano and Lovell (42) on the use of regional or physiographic subdivisions in the preliminary stages of planning and investigation. Each landform has been given a general rating (L, M, H or 1, 2, 3) for a specific highway or construction problem. Landforms that exhibit considerable variation in engineering properties have been rated over a range. Small areas which show extreme variation in texture and engineering behavior were not considered in the development of Table 5, which is based on the average landform-parent material behavior.

In the early stages of foundation or embankment design, it may be useful to quantitatively identify potential problems with bearing capacity, settlement, or slope stability. Many correlations exist for determining shear strength and compressibility parameters used in these analyses. Relationships between these parameters and classification test results such as Atterburg limits, grain size, density, and penetration resistance are most common in the

TABLE 5. SUMMARY OF ENGINEERING CONSIDERATIONS FOR LANDFORM—PARENT MATERIAL REGIONS IN GREENE COUNTY.

EXPLANATION

PROBABILITY OF A MAJOR PROBLEM DEVELOPING
L (LOW)
M (MEDIUM)
H (HIGH)

AVAILABILITY RATING
1 (LOW)
2 (MEDIUM)
3 (HIGH)

		CUT DESIGN					EMBANKMENT FILLS: COMPACTED PROPERTIES					EMBANKMENT FOUNDATION				SUBGRADE				FOUNDATION DESIGN: SHALLOW FOOTINGS			FOUNDATION DESIGN: PILES					MISCELLANEOUS				
LANDFORM	GENERAL SOIL TEXTURE	SOIL/ROCK BACKSLOPE INSTABILITY	GROUND WATER CONTROL	EROSION POTENTIAL	SURFACE DRAINAGE	NATURAL SLOPE AND RIVER BANK INSTABILITY	EROSION RESISTANCE	RELATIVE PERMEABILITY	INADEQUATE SHEAR STRENGTH	COMPRESSIBILITY WHEN SATURATED	WORKABILITY PROBLEMS	INADEQUATE SHEAR STRENGTH	EXCESSIVE SETTLEMENTS	ORGANIC DEPOSIT OCCURENCE	GROUNDWATER CONTROL	SUBGRADE SUPPORT INADEQUATE	FROST ACTION POTENTIAL	PUMPING POTENTIAL	SHRINK-SWELL POTENTIAL	INADEQUATE BEARING CAPACITY	EXCESSIVE SETTLEMENT POTENTIAL	SCOUR POTENTIAL	INADEQUATE BEARING CAPACITY	EXCESSIVE SETTLEMENT POTENTIAL	NEGATIVE SKIN FRICTION	SCOUR POTENTIAL	ESTIMATION OF LATERAL EARTH PRESSURES FOR RETAINING STRUCTURES	AVAILABILITY OF AGGREGATE	STEEL CORROSIVITY	CONCRETE CORROSIVITY	BEHAVIOR OF SEPTIC TANK FIELDS	GROUNDWATER RESOURCE POTENTIAL
LOESS PLAIN	SILT	H	H	M	M	H	H	2	M	M	M	M	M	L	L	M	M/H	H	H	M	M	M	L	L	M	M	M	1	M	M	M	1
SAND DUNES	SAND	M	M/H	M	M	M	M	1—3	M	M	M	M	M	L/M	M/L	M	L/M	M	L/M	M	M	M	M/H	M	L/M	M/L	M	2	M	M	H	2
ILLINOIAN GROUND MORAINE WITH LOESS MANTLE	SILT, CLAY	L	L	M	M	L/M	M	1—2	L/M	M/L	M/H	L	L/M	L	L	M	M/H	M/H	M	L	L	M	L	L	L	M/L	M	1	M	H	H	1
SLACKWATER PLAIN/TERRACE	SILT, CLAY	H/M	M	M/L	H/M	M	L	1	H/M	H	H	H/M	H	H/M	L	M	H	M	M/H	H	H	M	M	H	H	M/L	M	1	M	H	H	1
FLOOD PLAIN	SILT, SAND, CLAY	M	M	H	L/M	M	M	1—2	M	M	M/L	M/H	M/L	M/H	L	M	M	M/L	L	M/H	M	H	L/M	L/M	M	H	M	2	L	M	H	2
OUTWASH PLAIN/TERRACE	SAND, GRAVEL	L	M/H	M	L	L	M	2	L	L	L	L	L	L/M	L	L	L/M	L	L	L	L	L	L	L	L	L	L	2	L/M	L/M	L	2
SANDSTONE—SHALE PLATEAU WITH LOESS MANTLE	SILT, CLAY, ROCK FRAG.	M	M	H/M	M	M	M	2	L	L	L/M	M/L	L	L	L	L	L/M	L	L	M	L/M	L	L/M	L	L	L	L/M	1	L/M	L/M	H	1
SANDSTONE—SHALE BEDROCK	ROCK	M/L	L	L	M	L	L	1	L	L	L	L	L	L	L	L/M	L/M	L	L	L	L/M	L/M	L	L/M	L/M	L/M	L	1	L/M	L/M	H	1—2
RESIDUAL LIMESTONE SOILS ON PLATEAU/BENCH	SILT, CLAY, ROCK FRAG.	M/H	M	M	M	L	M	1	M	M	M/H	M	M/H	L/M	L	L/M	M	M	M	M/H	M/H	M	M/H	M	M	L/M	M	1	H/H	L/M	H	1
LIMESTONE BEDROCK	ROCK	M/L	L	L	H	L	L	1	L	L	L	L	L/M	L	L	L/M	M	L	L	M/N	M/H	L	M/H	L/M	M/H	L	L	1	M	L	H	1—2
ORGANIC DEPOSITS	PEAT, MUCK	H	L	M	H	H	H	1—3	H	H	M	H	H	H	L	L	L	H	H	H	H	H	M	M	H	H	H	1	H	H	H	1

literature. Figures 25 and 26 give correlations for shear strength parameters. Figure 25 illustrates the angle of shearing resistanse versus plasticity index for fine grain soils, and the angle of internal friction versus density for coarse grained soils (32). Figure 26 correlates standard penetration resistance (SPT N-value) to relative density of sand and unconfined compressive strength of clay (32). Settlement parameters can also be approximated. Many correlations exist for the compression index (i.e. $Cc = 0.009\{LL\text{-}10\}$), recompression index, and coefficient of secondary compression for silts, clays, and organic soils. Correlations also exist for the elastic modulus needed in immediate settlement calculations; however, these are usually based on regional experience with a given deposit.

Finally, Table 6 (Typical Properties of Compacted Materials) is given for preliminary design analyses of compacted embankments and earth dams.

These relationships have many limitations and are only suitable for preliminary estimates; however, they can be very helpful in identifying potential problems.

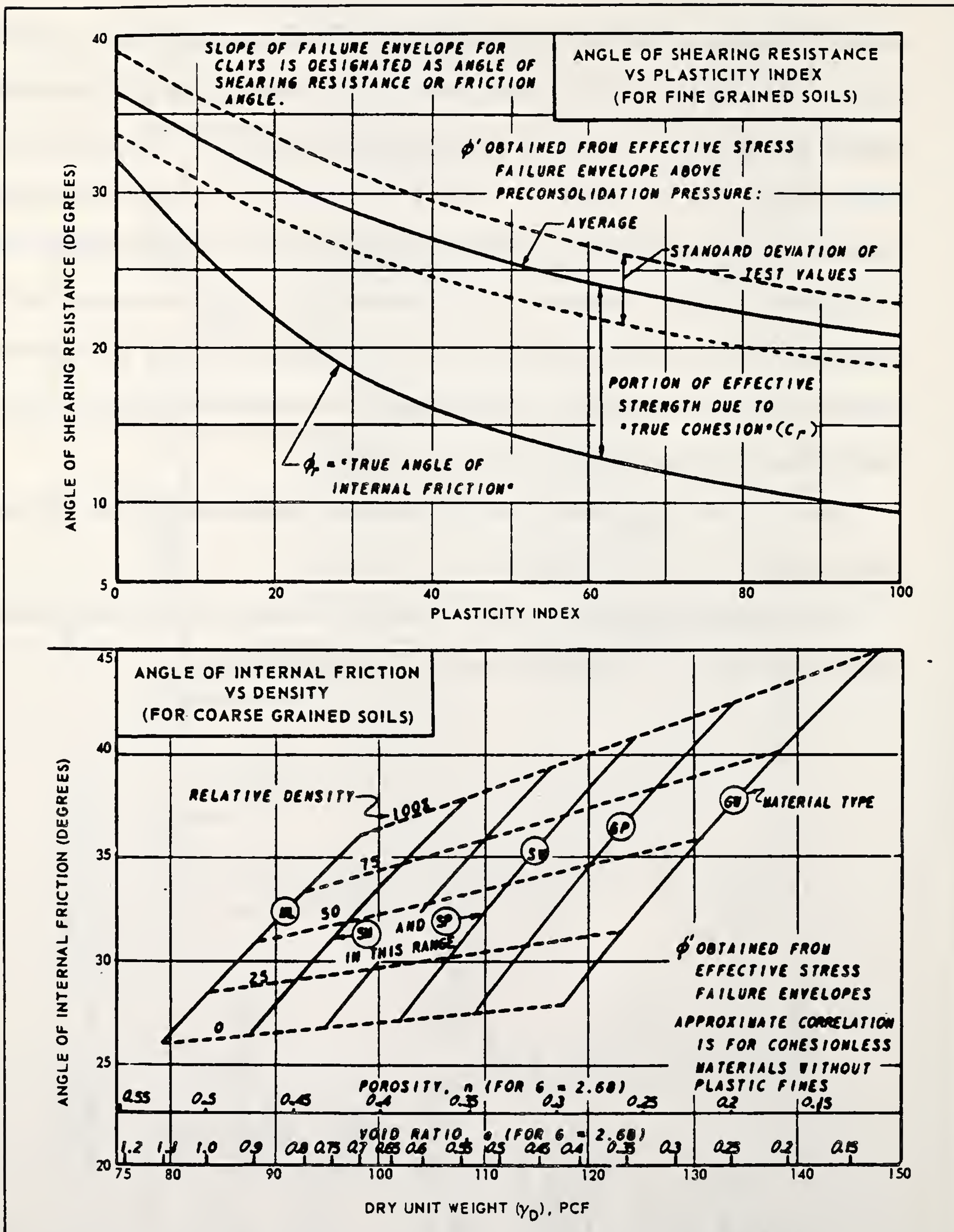


FIGURE 25. CORRELATIONS FOR STRENGTH PARAMETERS (32).

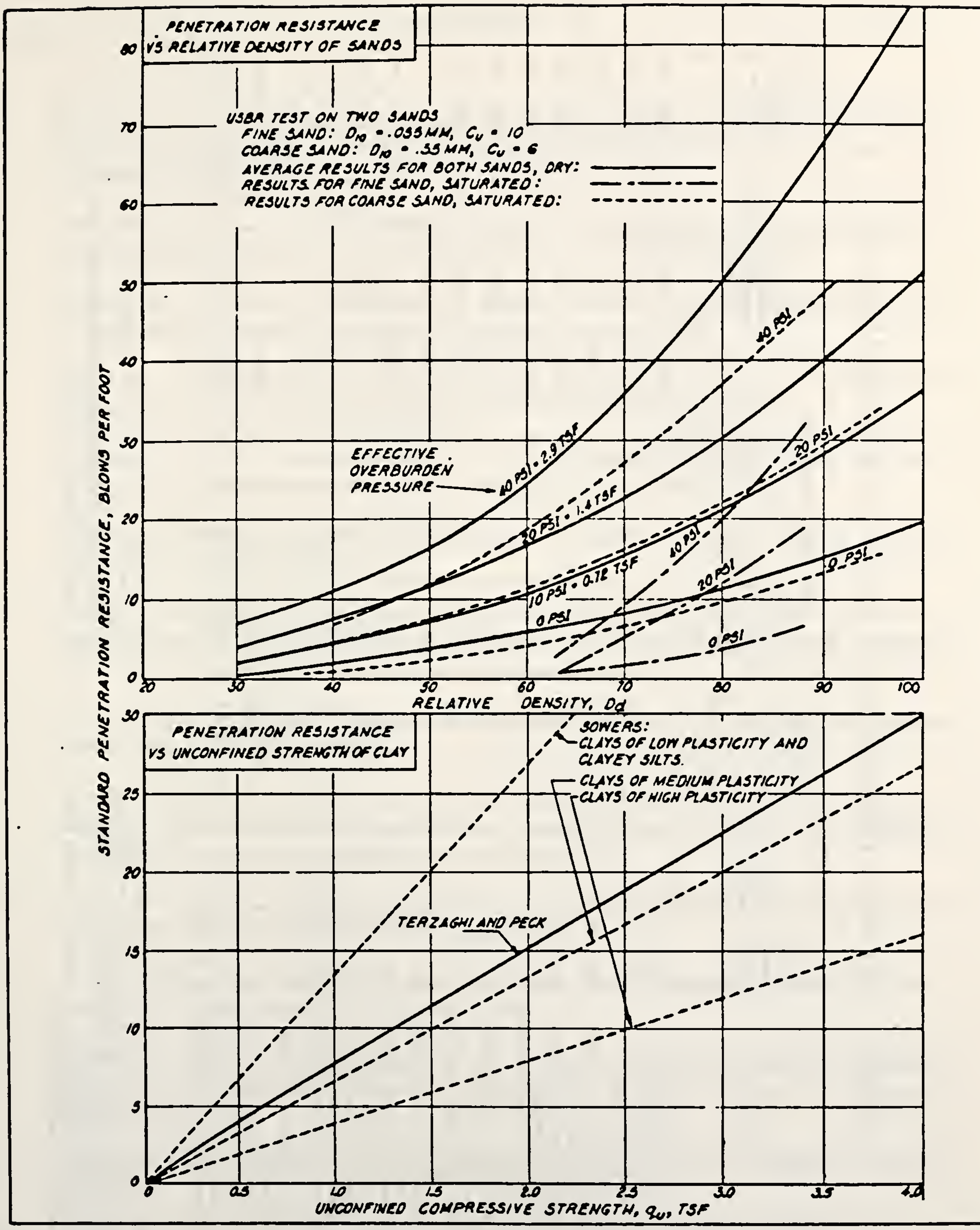


FIGURE 26. CORRELATIONS OF STANDARD PENETRATION RESISTANCE (32).

TABLE 6. TYPICAL PROPERTIES OF COMPACTED MATERIALS (32).

Group symbol	Soil type	Range of maximum dry unit weight, pcf	Range of optimum moisture, percent	Typical value of compression: At 1.4 tsf (20 psi)	At 3.6 tsf (50 psi)	Typical strength characteristics: Cohesion (as compacted) psf	Cohesion (saturated) psf	ϕ (Effective stress envelope) degrees	Tan ϕ	Typical coefficient of permeability ft/min.	Range of CBR values	Range of subgrade modulus k lb/cu in.
				percent of original height								
GW	Well graded clean gravels, gravel-sand mixtures.	125 - 135	11 - 8	0.3	0.6	0	0	>38	>0.79	5×10^{-2}	40 - 80	300 - 500
GP	Poorly graded clean gravels, gravel-sand mix.	115 - 125	14 - 11	0.4	0.9	0	0	>37	>0.74	10^{-1}	30 - 60	250 - 400
GM	Silty gravels, poorly graded gravel-sand-silt.	120 - 135	12 - 8	0.5	1.1	....	....	>34	>0.67	$>10^{-6}$	20 - 60	100 - 400
GC	Clayey gravels, poorly graded gravel-sand-clay.	115 - 130	14 - 9	0.7	1.6	....	....	>31	>0.60	$>10^{-7}$	20 - 40	100 - 300
SW	Well graded clean sands, gravelly sands.	110 - 130	16 - 9	0.6	1.2	0	0	38	0.79	$>10^{-3}$	20 - 40	200 - 300
SP	Poorly graded clean sands, sand-gravel mix.	100 - 120	21 - 12	0.8	1.4	0	0	37	0.74	$>10^{-3}$	10 - 40	200 - 300
SM	Silty sands, poorly graded sand-silt mix.	110 - 125	16 - 11	0.8	1.6	1050	420	34	0.67	5×10^{-5}	10 - 40	100 - 300
SM-SC	Sand-silt clay mix with slightly plastic fines.	110 - 130	15 - 11	0.8	1.4	1050	300	33	0.66	2×10^{-6}	....	
SC	Clayey sands, poorly graded sand-clay mix.	105 - 125	19 - 11	1.1	2.2	1550	230	31	0.60	5×10^{-7}	5 - 20	100 - 300
ML	Inorganic silts and clayey silts ..	95 - 120	24 - 12	0.9	1.7	1400	190	32	0.62	10^{-5}	15 or less	100 - 200
ML-CL	Mixture of inorganic silt and clay	100 - 120	22 - 12	1.0	2.2	1350	460	32	0.62	5×10^{-7}	....	
CL	Inorganic clays of low to med. plasticity.	95 - 120	24 - 12	1.3	2.5	1800	270	28	0.54	10^{-7}	15 or less	50 - 200
OL	Organic silts and silt-clays, low plasticity.	80 - 100	33 - 21	....	....	....	....	....	.....	....	5 or less	50 - 100
MH	Inorganic clayey silts, elastic silts.	70 - 95	40 - 24	2.0	3.8	1500	420	25	0.47	5×10^{-7}	10 or less	50 - 100
CH	Inorganic clays of high plasticity	75 - 105	36 - 19	2.6	3.9	2150	230	19	0.35	10^{-7}	15 or less	50 - 150
OH	Organic clays and silty clays ...	65 - 100	45 - 21	....	....	....	....	....	.....	....	5 or less	25 - 100

Notes:

1. All properties are for condition of "standard Proctor" maximum density, except values of k and CBR which are for "modified Proctor" maximum density.
2. Typical strength characteristics are for effective strength envelopes and are obtained from USBR data.
3. Compression values are for vertical loading with complete lateral confinement.
4. (>) indicates that typical property is greater than the value shown. (....) indicates insufficient data available for an estimate.

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APPENDIX A

CLASSIFICATION TEST RESULTS FOR SELECTED ENGINEERING PROJECTS IN GREENE COUNTY (43-61)

APPENDIX A. CLASSIFICATION TEST RESULTS FOR SELECTED ENGINEERING PROJECTS IN GREENE COUNTY (43—61).

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description		Blow per Ft.	RQD %	Grain Size Distribution				LL	PL	PI
							Texture	AASHTO			Gravel	Sand	Silt	Clay			
1	SR 54 over	1	300 + 38	31RT	494.4	1.0 - 2.5	Silty clay loam	A-7	10	-	-	-	-	-	-	-	-
"	Beehunter	2	"	"	"	3.5 - 5.0	"	"	2	-	-	-	-	-	-	-	-
"	Ditch	3	"	"	"	6.0 - 7.5	Silty loam	A-4, A-6	2	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	2	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	Sandstone	-	-	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	Shale	-	-	-	-	-	-	-	-	-	-
2	"	1	79 + 25	26RT	494.3	1.0 - 2.5	Silty loam	A-4, A-6	4	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	"	"	4	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	Silty clay	A-7	4	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.5	"	"	3	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	Silty loam	A-4, A-6	73	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	Shale	"	-	-	-	-	-	-	-	-	-
3	"	1	79 + 27	43RT	494.0	1.0 - 2.5	Clay loam	A-6, A-7	7	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	"	"	5	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	Silty clay	A-7	2	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	Silty loam	A-4, A-6	11	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	Weathered Shale	-	65	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	Shale	-	-	-	-	-	-	-	-	-	-
4	SR 48 over	1	100 + 02	64LT	512.0	1.0 - 2.5	Sand & Gravel	A-1	2	-	-	-	-	-	-	-	-
"	Branch	2	"	"	"	3.5 - 5.0	Silty clay loam	A-4(6)	11	-	0.8	21.3	50.2	27.7	31	22	9
"	Lagoon Creek	3	"	"	"	6.0 - 7.5	"	"	14	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	19	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	"	"	26	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	"	"	21	-	-	-	-	-	-	-	-
5	"	1	109 + 81	63LT	513.0	1.0 - 2.5	Silty clay loam	A-4	5	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	"	"	6	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	13	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	Sandy loam	A-2-4(0)	10	-	0.5	67.3	18.8	13.4	NP	NP	NP
"	"	5	"	"	"	13.5 - 15.0	"	"	27	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	Silty clay loam	A-4	13	-	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description		Blow per Ft.	RQD %	Grain Size Distribution				LL	PL	PI
							Texture	AASHTO			Gravel	Sand	Silt	Clay			
6	SR 48 over Branch Lagoon Creek	1	109 + 75	24RT	520.0	0.0 - 1.5	Silty loam	A-4(3)	6	-	-	-	-	-	-	-	-
"		2	"	"	"	1.5 - 3.0	"	"	3	-	1.3	12.1	72.9	13.7	27	22	5
"		3	"	"	"	3.5 - 5.0	Silty clay loam	A-6	3	-	-	-	-	-	-	-	-
"	"	4	"	"	"	6.0 - 7.5	"	"	5	-	-	-	-	-	-	-	-
"	"	5	"	"	"	8.5 - 10.0	"	"	7	-	-	-	-	-	-	-	-
"	"	6	"	"	"	13.5 - 15.0	"	"	6	-	-	-	-	-	-	-	-
"	"	7	"	"	"	18.5 - 20.0	"	"	15	-	-	-	-	-	-	-	-
"	"	8	"	"	"	23.5 - 25.0	"	"	16	-	-	-	-	-	-	-	-
"	"	9	"	"	"	28.5 - 30.0	"	"	15	-	-	-	-	-	-	-	-
"	"	10	"	"	"	33.5 - 35.0	Sandy loam	A-4	21	-	-	-	-	-	-	-	-
"	"	11	"	"	"	38.5 - 40.0	"	"	23	-	-	-	-	-	-	-	-
7	"	1	110 + 25	23RT	521.3	0.0 - 1.5	Silty loam	A-4	12	-	-	-	-	-	-	-	-
"	"	2	"	"	"	1.5 - 3.0	"	"	6	-	-	-	-	-	-	-	-
"	"	3	"	"	"	3.5 - 5.0	Silty clay loam	A-6(14)	6	-	0.6	17.1	57.2	25.1	35	17	18
"	"	4	"	"	"	6.0 - 7.5	"	"	7	-	-	-	-	-	-	-	-
"	"	5	"	"	"	8.5 - 10.0	"	"	7	-	-	-	-	-	-	-	-
"	"	6	"	"	"	13.5 - 15.0	"	"	9	-	-	-	-	-	-	-	-
"	"	7	"	"	"	18.5 - 20.0	"	"	7	-	-	-	-	-	-	-	-
"	"	8	"	"	"	23.5 - 25.0	Gravelly sand	A-1-b(0)	26	-	28.4	63.2	4.2	4.2	NP	NP	NP
"	"	9	"	"	"	28.5 - 30.0	"	"	39	-	-	-	-	-	-	-	-
"	"	10	"	"	"	33.5 - 35.0	Sandy loam	A-4(0)	50/.5	-	8.7	42.7	38.5	10.1	19	16	3
"	"	11	"	"	"	38.5 - 40.0	Clay loam	A-6(11)	27	-	-	-	-	-	-	-	-
"	"	12	"	"	"	43.5 - 45.0	"	"	21	-	1.6	29.4	42.3	26.7	35	16	19
"	"	13	"	"	"	48.5 - 50.0	"	"	29	-	-	-	-	-	-	-	-
8	SR 231 over Morgan Ditch	1	225 + 28	12RT	507.4	1.0 - 2.5	Sandy loam	A-2-4(0)	6	-	0.2	76.4	11.9	11.5	NP	NP	NP
"		2	"	"	"	3.5 - 5.0	"	"	8	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	7	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	Sand	A-3	7	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	"	"	7	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	"	"	35	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	"	"	52	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	"	"	39	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.0	"	"	21	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.0	"	"	42	-	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description: Texture	Soil Description: AASHTO	Blow per Ft.	RQD %	Grain Size Distribution: Gravel	Grain Size Distribution: Sand	Grain Size Distribution: Silt	Grain Size Distribution: Clay	LL	PL	PI
9	SR 231 over	1	226 + 21	13LT	507.3	1.0 - 2.5	Sandy loam	A-2-4	6	-	-	-	-	-	-	-	-
"	Morgan Ditch	2	"	"	"	3.5 - 5.0	"	"	7	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	7	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	Clay	A-7-6	5	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	Sand	A-3(0)	13	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	"	"	19	-	8.0	87.1	2.5	2.4	NP	NP	NP
"	"	7	"	"	"	23.5 - 25.0	"	"	41	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	"	"	25	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.0	"	"	39	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.0	"	"	28	-	-	-	-	-	-	-	-
"	"	11	"	"	"	43.5 - 45.0	"	"	35	-	-	-	-	-	-	-	-
"	"	12	"	"	"	48.5 - 50.0	"	"	38	-	-	-	-	-	-	-	-
10	SR 231 over	1	225 + 93	14RT	507.3	1.0 - 2.5	Sandy clay loam	A-6	8	-	-	-	-	-	-	-	-
"	Morgan Ditch	2	"	"	"	3.5 - 5.0	"	"	8	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	Sand	A-3	7	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	Sand loam	A-2-4	6	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	Sand	A-3	7	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	"	"	18	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	"	"	50	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	"	"	28	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.0	"	"	44	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.0	"	"	26	-	-	-	-	-	-	-	-
11	SR 231 over	1	227 + 35	60LT	503.8	1.0 - 2.5	Sandy loam	A-2-4	13	-	-	-	-	-	-	-	-
"	Morgan Ditch	2	"	"	"	3.5 - 5.0	Clay	A-7-6(19)	13	-	0.1	33.4	25.7	40.8	50	19	31
"	"	3	"	"	"	6.0 - 7.5	Sand	A-3	15	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	14	-	-	-	-	-	-	-	-
12	SR 57 over	1	1660 + 86	23RT	508.5	0.5 - 2.0	Silty clay	A-7	7	-	-	-	-	-	-	-	-
"	Lattas Creek	2	"	"	"	2.5 - 4.0	"	"	7	-	-	-	-	-	-	-	-
"	"	3	"	"	"	5.0 - 6.5	"	"	7	-	-	-	-	-	-	-	-
"	"	4	"	"	"	7.5 - 9.0	"	"	9	-	-	-	-	-	-	-	-
"	"	5	"	"	"	10.0 - 11.5	"	"	4	-	-	-	-	-	-	-	-
"	"	6	"	"	"	15.0 - 16.5	"	"	10	-	-	-	-	-	-	-	-
"	"	7	"	"	"	20.0 - 21.5	"	"	6	-	-	-	-	-	-	-	-
"	"	8	"	"	"	25.0 - 26.5	"	"	14	-	-	-	-	-	-	-	-
"	"	9	"	"	"	30.0 - 31.5	Silty clay loam	A-6	88	-	-	-	-	-	-	-	-
"	"	10RC	"	"	"	31.5 - 36.5	Sandstone and thin shale	-	-	96	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description: Texture	Soil Description: AASHTO	Blow per Ft.	RQD %	Grain Size Distribution: Gravel	Sand	Silt	Clay	LL	PL	PI
13	SR 57 over	1	1661 + 25	19LT	485.8	1.0 - 2.5	Silty clay	A-7	2	-	-	-	-	-	-	-	-
"	Lattas Creek	2	"	"	"	2.5 - 4.0	"	"	11	-	-	-	-	-	-	-	-
"	"	3	"	"	"	5.0 - 6.5	Silty clay w/gravel	A-6	101/.5	96	-	-	-	-	-	-	-
"	"	4RC	"	"	"	8.1 - 13.1	Sandstone and thin shale	-	-	-	-	-	-	-	-	-	-
14	"	1	1661 + 69	19RT	486.0	0.0 - 1.5	Silty clay	A-7	2	-	-	-	-	-	-	-	-
"	"	2	"	"	"	2.5 - 4.0	Clay	"	4	-	-	-	-	-	-	-	-
"	"	3	"	"	"	5.0 - 6.5	Silty clay loam	A-6	9	-	-	-	-	-	-	-	-
"	"	4	"	"	"	7.5 - 9.0	Sandy clay loam	"	18	-	-	-	-	-	-	-	-
"	"	5	"	"	"	10.0 - 10.8	"	"	101/.3	-	-	-	-	-	-	-	-
"	"	6RC	"	"	"	10.8 - 15.8	Sandstone and thin shale	-	-	100	-	-	-	-	-	-	-
15	"	1	1662 + 08	23LT	508.5	0.0 - 1.5	Sandy gravel (fill)	A-1	6	-	-	-	-	-	-	-	-
"	"	2	"	"	"	2.5 - 4.0	Silty clay (fill)	A-6	3	-	-	-	-	-	-	-	-
"	"	3	"	"	"	5.0 - 6.5	"	"	5	-	-	-	-	-	-	-	-
"	"	4	"	"	"	7.5 - 9.0	Sand (fill)	A-3	7	-	-	-	-	-	-	-	-
"	"	5	"	"	"	10.0 - 11.5	"	"	8	-	-	-	-	-	-	-	-
"	"	6	"	"	"	20.0 - 21.5	Silty Clay	A-7	7	-	-	-	-	-	-	-	-
"	"	7	"	"	"	20.0 - 21.5	Clay	"	9	-	-	-	-	-	-	-	-
"	"	8	"	"	"	25.0 - 26.5	"	"	7	-	-	-	-	-	-	-	-
"	"	9	"	"	"	30.0 - 31.5	"	"	2	-	-	-	-	-	-	-	-
"	"	10	"	"	"	35.0 - 36.5	"	"	3	-	-	-	-	-	-	-	-
"	"	11	"	"	"	40.0 - 41.5	"	"	11	-	-	-	-	-	-	-	-
"	"	12	"	"	"	50.0 - 51.5	Sandy loam	"	10	-	-	-	-	-	-	-	-
"	"	13	"	"	"	55.5 - 60.5	Shale w/thin sandstone	-	-	76	-	-	-	-	-	-	-
16	SR 54 over	1	35 + 71	12RT	576.9	1.0 - 2.5	Sandy loam	A-2-4	7	-	-	-	-	-	-	-	-
"	Illinois	2	"	"	"	3.5 - 5.0	Silty clay loam	A-6	9	-	-	-	-	-	-	-	-
"	Central	3	"	"	"	6.0 - 7.5	Sand loam	A-2-4	6	-	-	-	-	-	-	-	-
"	Railroad	4	"	"	"	8.5 - 10.0	"	"	7	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	Silty clay loam	A-6	9	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	"	"	16	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	Sandy loam	A-2-4	5	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	"	"	4	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.0	"	"	13	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.0	"	"	18	-	-	-	-	-	-	-	-
"	"	11	"	"	"	43.5 - 45.0	Sandstone	-	-	-	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description: Texture	Soil Description: AASHTO	Blow per Ft.	RQD %	Grain Size Distribution: Gravel	Sand	Silt	Clay	LL	PL	PI
17	SR 54 over	1	36 + 40	20LT	552.1	1.0 - 2.5	Sandy loam (fill)	A-2-4	11	-	-	-	-	-	-	-	-
"	Illinois	2	"	"	"	3.5 - 5.0	"	"	16	-	-	-	-	-	-	-	-
"	Central	3	"	"	"	6.0 - 7.5	"	"	4	-	-	-	-	-	-	-	-
"	Railroad	4	"	"	"	8.5 - 10.0	Silty clay loam	A-6	4	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	"	"	11	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	Sand	A-3	8	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	"	"	7	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	"	"	7	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.0	Silty clay loam	A-6	8	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.0	Sandstone	-	-	-	-	-	-	-	-	-	-
18	"	1	38 + 22	70LT	542.3	1.0 - 2.5	Sandy loam (fill)	-	2	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	Sandy loam	A-2-6	8	-	0.0	31.0	35.0	34.0	36	20	16
"	"	3	"	"	"	6.0 - 7.5	Clay	A-6(9)	9	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	3	-	-	-	-	-	-	-	-
"	"	5	"	"	"	11.0 - 12.5	"	"	13	-	-	-	-	-	-	-	-
"	"	6	"	"	"	13.5 - 15.0	Sandy loam	A-2-6	14	-	-	-	-	-	-	-	-
19	"	1	39 + 12	62LT	539.5	1.0 - 2.5	Clay	A-6(0)	1	-	0.0	21.0	48.0	31.0	33	20	13
"	"	2	"	"	"	3.5 - 5.0	"	"	1	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	A-6	6	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	12	-	-	-	-	-	-	-	-
"	"	5	"	"	"	11.0 - 12.5	"	A-6(15)	12	-	0.0	28.0	39.0	33.0	39	16	23
"	"	6	"	"	"	13.5 - 15.0	"	"	13	-	-	-	-	-	-	-	-
"	"	7	"	"	"	18.5 - 20.0	"	"	9	-	-	-	-	-	-	-	-
20	"	1	45 + 40	50LT	561.3	1.0 - 2.5	Loam	A-4	17	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	"	"	19	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	Clay	A-6	22	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	Sandy loam	A-2-6(0)	13	-	0.0	78.0	10.0	12.0	31	15	16
"	"	5	"	"	"	11.0 - 12.5	Weathered sandstone	-	106	-	-	-	-	-	-	-	-
"	"	6	"	"	"	13.5 - 15.0	"	-	50/.4	-	-	-	-	-	-	-	-
"	"	7	"	"	"	16.0 - 17.5	"	-	50/.2	-	-	-	-	-	-	-	-
"	"	8	"	"	"	18.5 - 20.0	"	-	29	-	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description		Blow per Ft.	RQD %	Grain Size Distribution				LL	PL	PI
							Texture	AASHTO			Gravel	Sand	Silt	Clay			
21	Base Road	1	17 + 17	8RT	502.3	1.0 - 2.5	Loam	A-4	5	-	-	-	-	-	-	-	-
"	South over	2	"	"	"	3.5 - 5.0	"	"	8	-	-	-	-	-	-	-	-
"	Bogard Creek	3	"	"	"	6.0 - 7.5	"	"	4	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	3	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	Silty clay loam	A-6	3	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	"	"	8	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	Shale	-	72	-	-	-	-	-	-	-	-
"	"	8	"	"	"	25.0 - 30.0	"	-	-	53	-	-	-	-	-	-	-
22	"	1	17 + 76	6LT	501.0	1.0 - 2.5	Loam	A-4(0)	3	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	Sand	A-3	4	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	Loam	A-4	3	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	3	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	Silty clay loam	A-6(16)	4	-	0.0	2.0	75.0	23.0	39	25	14
"	"	6	"	"	"	18.5 - 20.0	"	"	6	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	"	"	10	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	Shale	-	46	-	-	-	-	-	-	-	-
"	"	9	"	"	"	30.0 - 35.0	"	-	-	47	-	-	-	-	-	-	-
23	SR 45 and 58	1	170 + 25	50RT	600.94	1.0 - 2.5	Sandy loam	A-2-4	16	-	-	-	-	-	-	-	-
"	Near Doans	2	"	"	"	3.5 - 5.0	Silty clay	A-6(11)	38	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	19	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	20	-	0.0	8.5	53.9	37.6	31	18	13
"	"	5	"	"	"	11.0 - 12.5	"	"	17	-	-	-	-	-	-	-	-
"	"	6	"	"	"	13.5 - 15.0	"	"	9	-	-	-	-	-	-	-	-
"	"	7	"	"	"	16.0 - 17.5	Clay	A-7-6(22)	11	-	-	-	-	-	-	-	-
"	"	8	"	"	"	18.5 - 20.0	"	"	11	-	-	-	-	-	-	-	-
"	"	9	"	"	"	21.0 - 22.5	"	"	10	-	-	-	-	-	-	-	-
"	"	10	"	"	"	23.5 - 25.0	"	"	6	-	0.0	0.4	29.3	70.3	43	24	19
"	"	11	"	"	"	26.0 - 27.5	"	"	7	-	-	-	-	-	-	-	-
"	"	12	"	"	"	28.5 - 30.0	"	"	5	-	-	-	-	-	-	-	-
"	"	13	"	"	"	31.0 - 32.5	"	"	4	-	-	-	-	-	-	-	-
"	"	14	"	"	"	33.5 - 35.0	"	"	4	-	-	-	-	-	-	-	-
"	"	15	"	"	"	36.0 - 37.5	"	"	6	-	-	-	-	-	-	-	-
"	"	16	"	"	"	38.5 - 40.0	"	"	6	-	-	-	-	-	-	-	-
"	"	17	"	"	"	41.0 - 42.5	"	"	9	-	-	-	-	-	-	-	-
"	"	18	"	"	"	43.5 - 45.0	"	"	16	-	-	-	-	-	-	-	-
"	"	19	"	"	"	46.0 - 47.5	"	"	6	-	-	-	-	-	-	-	-
"	"	20	"	"	"	48.5 - 50.0	"	"	5	-	-	-	-	-	-	-	-
"	"	21	"	"	"	51.0 - 52.5	"	"	10	-	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description: Texture	Soil Description: AASHTO	Blow per Ft.	RQD %	Grain Size Distribution: Gravel	Sand	Silt	Clay	LL	PL	PI
"	"	22	"	"	"	53.5 - 55.0	"	"	22	-	-	-	-	-	-	-	-
"	"	23	"	"	"	56.0 - 57.5	"	"	9	-	-	-	-	-	-	-	-
"	"	24	"	"	"	58.5 - 60.0	Loam w/sand-stone and coal fragments	A-4(0)	15	-	-	-	-	-	-	-	-
"	"	25	"	"	"	61.0 62.5	"	"	19	-	3.9	41.4	36.0	18.7	18	15	3
"	"	26	"	"	"	63.5 - 65.0	"	"	26	-	-	-	-	-	-	-	-
"	"	27	"	"	"	66.0 - 67.5	"	"	24	-	-	-	-	-	-	-	-
"	"	28	"	"	"	68.5 - 70.0	Weathered shale	-	21	-	-	-	-	-	-	-	-
"	"	29	"	"	"	71.0 - 72.5	"	-	50/.4	-	-	-	-	-	-	-	-
"	"	30	"	"	"	73.5 - 75.0	"	-	50/.4	-	-	-	-	-	-	-	-
24	"	1	170 + 25	150RT	598.53	3.5 - 5.0	Silty Clay	A-6	15	-	-	-	-	-	-	-	-
"	"	2	"	"	"	8.5 - 10.0	"	"	14	-	-	-	-	-	-	-	-
"	"	3	"	"	"	13.5 - 15.0	"	"	8	-	-	-	-	-	-	-	-
"	"	4	"	"	"	18.5 - 20.0	Clay	A-7-6	3	-	-	-	-	-	-	-	-
"	"	5	"	"	"	21.0 - 23.0	"	"	-	-	-	-	-	-	-	-	-
"	"	6	"	"	"	23.5 - 25.0	"	"	5	-	-	-	-	-	-	-	-
25	"	1	170 + 25	250RT	598.51	3.5 - 5.0	Silty clay	A-6	11	-	-	-	-	-	-	-	-
"	"	2	"	"	"	8.5 - 10.0	"	"	27	-	-	-	-	-	-	-	-
"	"	3	"	"	"	13.5 - 15.0	"	"	25	-	-	-	-	-	-	-	-
"	"	4	"	"	"	18.5 - 20.0	Clay	A-7-6	11	-	-	-	-	-	-	-	-
"	"	5	"	"	"	23.5 - 25.0	"	"	9	-	-	-	-	-	-	-	-
"	"	6	"	"	"	28.5 - 30.5	"	"	-	-	-	-	-	-	-	-	-
"	"	7	"	"	"	33.5 - 35.0	"	"	4	-	-	-	-	-	-	-	-
"	"	8	"	"	"	38.5 - 40.0	"	"	5	-	-	-	-	-	-	-	-
"	"	9	"	"	"	43.5 - 45.0	"	"	5	-	-	-	-	-	-	-	-
"	"	10	"	"	"	48.5 - 50.5	"	-	-	-	-	-	-	-	-	-	-
"	"	11	"	"	"	53.5 - 55.0	"	"	5	-	-	-	-	-	-	-	-
"	"	12	"	"	"	58.5 - 60.0	"	"	6	-	-	-	-	-	-	-	-
"	"	13	"	"	"	63.5 - 65.0	"	"	6	-	-	-	-	-	-	-	-
"	"	14	"	"	"	66.0 - 68.0	"	"	-	-	-	-	-	-	-	-	-
"	"	15	"	"	"	68.5 - 70.0	"	"	6	-	-	-	-	-	-	-	-
"	"	16	"	"	"	73.5 - 75.0	"	"	6	-	-	-	-	-	-	-	-
"	"	17	"	"	"	78.5 - 80.0	Loam	A-4	24	-	-	-	-	-	-	-	-
"	"	18	"	"	"	83.5 - 85.0	"	"	40	-	-	-	-	-	-	-	-
"	"	19	"	"	"	88.5 - 90.0	Weathered shale	-	58	-	-	-	-	-	-	-	-
"	"	20	"	"	"	93.5 - 94.5	"	-	50/.3	-	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description: Texture	Soil Description: AASHTO	Blow per Ft.	RQD %	Grain Size Distribution: Gravel	Sand	Silt	Clay	LL	PL	PI
26	SR 45 and 58	1	174 + 25	103RT	590.0	1.0 - 2.5	Loam	A-4(2)	4	-	77.0	27.0	40.0	16.0	25	17	8
"	Near Doans	2	"	"	"	3.5 - 5.0	"	"	-	-	-	-	-	-	-	-	-
"	Ditch	3	"	"	"	6.0 - 7.5	Silty clay	A-7	10	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.5	Clay	A-7-6(30)	9	-	0.0	1.0	32.0	67.0	50	23	27
"	"	5	"	"	"	13.5 - 15.0	"	A-6	9	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	"	"	9	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	"	"	7	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.5	"	"	10	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.5	Sand	A-3	8	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.5	"	"	21	-	-	-	-	-	-	-	-
"	"	11	"	"	"	41.4 - 43.5	Sandstone	-	50/.4	-	-	-	-	-	-	-	-
"	"	12	"	"	"	43.5 - 48.0	Shale	-	-	-	-	-	-	-	-	-	-
27	"	1	174 + 30	103RT	590.0	13.0 - 15.0	Clay	A-7-6(35)	-	-	0.0	0.0	21.0	79.0	53	22	31
"	"	2	"	"	"	23.0 - 25.0	"	A-6(19)	-	-	0.0	0.0	44.0	56.0	37	19	18
28	"	1	174 + 30	185RT	582.5	3.5 - 5.5	Clay	A-7-5(27)	-	-	0.0	8.0	40.0	52.0	47	21	26
"	"	2	"	"	"	13.5 - 15.5	"	A-7-6(31)	-	-	16.0	0.0	18.0	66.0	60	27	33
"	"	3	"	"	"	33.5 - 35.5	Silty Clay	A-6(13)	-	-	0.0	0.0	63.0	37.0	33	20	13
29	SR 58 West	1	507 + 64	20RT	807.4	1.0 - 2.5	Clay	A-6(6)	14	-	-	-	-	-	-	-	-
"	of Owensburg	2	"	"	"	3.5 - 5.0	"	"	15	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	10	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	10	-	-	-	-	-	-	-	-
"	"	5	"	"	"	11.0 - 12.3	Weathered shale	-	26-15.3	-	-	-	-	-	-	-	-
"	"	6	"	"	"	13.5 - 13.9	Weathered sand-stone	-	50/.4	-	-	-	-	-	-	-	-
"	"	7	"	"	"	16.0 - 16.2	"	-	50/.2	-	-	-	-	-	-	-	-
"	"	8	"	"	"	18.5 - 20.0	Weathered shale	-	72	-	-	-	-	-	-	-	-
"	"	9	"	"	"	21.0 - 21.4	"	-	50/.4	-	-	-	-	-	-	-	-
"	"	10	"	"	"	23.5 - 24.3	"	-	45-50/.3	-	-	-	-	-	-	-	-
"	"	11	"	"	"	26.0 - 26.75	"	-	38-50/.25	-	-	-	-	-	-	-	-
"	"	12	"	"	"	28.5 - 29.3	"	-	44-50/.3	-	-	-	-	-	-	-	-
"	"	13	"	"	"	31.0 - 33.0	Coal	-	-	-	-	-	-	-	-	-	-
"	"	14	"	"	"	33.0 - 35.5	Shale	-	-	-	-	-	-	-	-	-	-
"	"	15	"	"	"	35.5 - 37.3	Limestone	-	-	-	-	-	-	-	-	-	-
"	"	16	"	"	"	37.7 - 39.3	Shale	-	-	-	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description		Blow per Ft.	RQD %	Grain Size Distribution				LL	PL	PI
							Texture	AASHTO			Gravel	Sand	Silt	Clay			
30	SR 58 West	1	507 + 66	15LT	806.3	1.0 - 2.5	Clay	A-6	6	-	-	-	-	-	-	-	-
"	of Owensburg	2	"	"	"	3.5 - 5.0	"	"	16	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	15	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	16	-	-	-	-	-	-	-	-
"	"	5	"	"	"	11.0 - 12.5	"	"	17	-	-	-	-	-	-	-	-
"	"	6	"	"	"	13.5 - 15.0	"	"	23	-	-	-	-	-	-	-	-
"	"	7	"	"	"	16.0 - 17.7	"	"	13	-	-	-	-	-	-	-	-
"	"	8	"	"	"	18.5 - 20.0	Silty clay	A-4(8)	55	-	-	-	-	-	-	-	-
"	"	9	"	"	"	21.0 - 22.5	"	"	47	-	-	-	-	-	-	-	-
"	"	10	"	"	"	23.5 - 25.0	"	"	86	-	-	-	-	-	-	-	-
"	"	11	"	"	"	26.0 - 26.9	"	"	25-54/.4	-	0.2	8.1	57.8	33.9	31	21	10
"	"	12	"	"	"	28.5 - 29.4	"	"	34-50/.4	-	-	-	-	-	-	-	-
"	"	13	"	"	"	31.0 - 31.75	Shale	-	37-50/.25	-	-	-	-	-	-	-	-
31	SR 58 West	1	509 + 50	15.5LT	797.2	1.0 - 2.5	Clay	A-6	13	-	-	-	-	-	-	-	-
"	of Owensburg	2	"	"	"	3.5 - 5.0	"	"	18	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	19	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	Sandy loam	A-2-4	28	-	-	-	-	-	-	-	-
"	"	5	"	"	"	11.0 - 12.5	Clay	A-6	13	-	-	-	-	-	-	-	-
"	"	6	"	"	"	13.5 - 15.0	"	"	28	-	-	-	-	-	-	-	-
"	"	7	"	"	"	16.0 - 17.7	Silty clay	A-4	38	-	-	-	-	-	-	-	-
"	"	8	"	"	"	18.5 - 20.0	Coal	-	40	-	-	-	-	-	-	-	-
"	"	9	"	"	"	21.0 - 22.5	Silty clay	A-4	54	-	-	-	-	-	-	-	-
"	"	10	"	"	"	26.0 - 33.8	Shale	-	-	-	-	-	-	-	-	-	-
32	SR 58 West	1	507 + 25	16LT	808.7	1.0 - 2.5	Clay	A-7	10	-	-	-	-	-	-	-	-
"	of Owensburg	2	"	"	"	3.5 - 5.0	Loam	A-4, A-6	11	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	Silty clay	A-7	13	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	10	-	-	-	-	-	-	-	-
"	"	5	"	"	"	11.0 - 12.5	"	"	15	-	-	-	-	-	-	-	-
"	"	6	"	"	"	13.5 - 15.0	"	"	13	-	-	-	-	-	-	-	-
"	"	7	"	"	"	16.0 - 16.8	"	"	5-50/.3	-	-	-	-	-	-	-	-
"	"	8	"	"	"	18.5 - 18.8	Sandstone	-	100/.3	-	-	-	-	-	-	-	-
"	"	9	"	"	"	21.0 - 22.4	Weathered shale	A-4	39-50/.4	-	-	-	-	-	-	-	-
"	"	10	"	"	"	23.5 - 24.9	"	"	-	-	-	-	-	-	-	-	-
"	"	11	"	"	"	26.0 - 26.7	"	"	45-50/.2	-	-	-	-	-	-	-	-
"	"	12	"	"	"	28.5 - 29.2	"	"	73-50/.2	-	-	-	-	-	-	-	-
"	"	13	"	"	"	31.0 - 31.9	"	"	51-50/.4	-	-	-	-	-	-	-	-
"	"	14	"	"	"	33.5 - 34.25	Shale	-	-	-	-	-	-	-	-	-	-
"	"	15	"	"	"	36.0 - 36.95	"	-	-	-	-	-	-	-	-	-	-
"	"	16	"	"	"	38.5 - 38.9	Coal	-	-	-	-	-	-	-	-	-	-
"	"	17	"	"	"	41.0 - 41.4	Shale	-	-	-	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description: Texture	Soil Description: AASHTO	Blow per Ft.	RQD %	Grain Size Distribution: Gravel	Sand	Silt	Clay	LL	PL	PI
33	SR 58 West	1	507 + 65	69LT	785.8	0.0 - 1.5	Clay w/gravel	A-6	5	-	-	-	-	-	-	-	-
"	of Owensburg	2	"	"	"	2.5 - 4.0	"	"	10	-	-	-	-	-	-	-	-
"	"	3	"	"	"	5.0 - 6.5	"	"	27	-	-	-	-	-	-	-	-
"	"	4	"	"	"	7.5 - 9.0	Silty clay	A-6(11)	16	-	-	-	-	-	-	-	-
"	"	5	"	"	"	10.0 - 11.5	"	"	14	-	0.0	15.2	52.7	32.1	33	19	14
"	"	6	"	"	"	12.5 - 14.0	"	"	13	-	-	-	-	-	-	-	-
"	"	7	"	"	"	15.0 - 16.5	"	"	16	-	-	-	-	-	-	-	-
"	"	8	"	"	"	17.5 - 18.7	Weathered shale	-	70-50/.2	-	-	-	-	-	-	-	-
"	"	9	"	"	"	20.0 - 21.2	"	-	50-50/.2	-	-	-	-	-	-	-	-
"	"	10	"	"	"	21.2 - 22.5	Coal	-	-	-	-	-	-	-	-	-	-
"	"	11	"	"	"	22.5 - 27.7	Shale	-	-	-	-	-	-	-	-	-	-
34	SR 58 West	1	508 + 25	71LT	785.5	0.0 - 1.5	Silty clay	A-6	4	-	-	-	-	-	-	-	-
"	of Owensburg	2	"	"	"	2.5 - 4.0	Clay	"	8	-	-	-	-	-	-	-	-
"	"	3	"	"	"	5.0 - 6.5	"	"	7	-	-	-	-	-	-	-	-
"	"	4	"	"	"	7.5 - 9.0	"	"	8	-	-	-	-	-	-	-	-
"	"	5	"	"	"	10.0 - 11.5	"	"	9	-	-	-	-	-	-	-	-
"	"	6	"	"	"	12.5 - 14.0	Silty clay	A-4	12	-	-	-	-	-	-	-	-
"	"	7	"	"	"	15.0 - 16.5	Coal	-	69	-	-	-	-	-	-	-	-
"	"	8	"	"	"	17.5 - 25.1	Shale	-	-	-	-	-	-	-	-	-	-
35	SR 54 over	1	881 + 50	25LT	608.0	1.0 - 2.5	Silty loam	A-4	6	-	-	-	-	-	-	-	-
"	Branch of	2	"	"	"	3.5 - 5.0	Silty clay loam	A-7	2	-	-	-	-	-	-	-	-
"	Indian Creek	3	"	"	"	6.0 - 7.5	Sandy clay	"	3	-	-	-	-	-	-	-	-
36	SR 54 over	1	881 + 90	35RT	605.0	1.0 - 2.5	Sandy loam	A-2-4	2	-	-	-	-	-	-	-	-
"	Branch of	2	"	"	"	3.5 - 5.0	Silty loam	A-4	21	-	-	-	-	-	-	-	-
"	Indian Creek	3	"	"	"	6.0 - 7.5	Sand	A-3	7	-	-	-	-	-	-	-	-
"	"	4RC	"	"	"	8.5 - 13.5	Limestone	-	-	68	-	-	-	-	-	-	-
37	SR 54 over	1	883 + 10	30LT	607.0	1.0 - 2.5	Silty loam	A-4	4	-	-	-	-	-	-	-	-
"	Branch of	2	"	"	"	3.5 - 5.0	Silty clay	"	2	-	-	-	-	-	-	-	-
"	Indian Creek	3	"	"	"	6.0 - 7.5	Silty loam	"	11	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	Sand	A-3	12	-	-	-	-	-	-	-	-
"	"	5RC	"	"	"	11.0 - 16.0	Limestone	-	-	43	-	-	-	-	-	-	-
38	SR 54 over	1	883 + 20	15RT	603.0	1.0 - 2.5	Sand	A-3	8	-	-	-	-	-	-	-	-
"	Branch of	2	"	"	"	3.0 - 3.8	Silty clay	A-7	50.3	-	-	-	-	-	-	-	-
"	Indian Creek	3	"	"	"	3.8 - 6.0	Limestone	-	-	95	-	-	-	-	-	-	-
"	"	4	"	"	"	6.0 - 8.8	"	-		70	-	-	-	-	-	-	-
"	"	5RC	"	"	"	11.0 - 16.0	Limestone	-	-	43	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description: Texture	Soil Description: AASHTO	Blow per Ft.	RQD %	Grain Size Distribution: Gravel	Sand	Silt	Clay	LL	PL	PI
39	SR 54 over	1	884 + 20	35LT	605.0	0.0 - 2.5	Silty loam	A-4	3	-	-	-	-	-	-	-	-
"	Branch of	2	"	"	"	3.5 - 5.0	Clay	A-6(15)	4	-	4.0	16.0	46.0	34.0	38	18	20
"	Indian Creek	3	"	"	"	6.0 - 7.5	Sand	A-3	6	-	-	-	-	-	-	-	-
"	"	4RC	"	"	"	8.4 - 13.4	Limestone	-	-	59	-	-	-	-	-	-	-
40	"	1	884 + 50	25LT	607.0	1.0 - 2.5	Silty clay	A-7	6	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	Sandy clay	"	10	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	Sand	A-3	13	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 8.7	Sand loam	A-2-4	50/.2	-	-	-	-	-	-	-	-
41	CR 475 North	1	16 + 00	CL	478.7	1.0 - 2.5	Clay	A-7-6	31	-	-	-	-	-	-	-	-
"	over Illinois	2	"	"	"	3.5 - 5.0	Silty clay	A-6	16	-	-	-	-	-	-	-	-
"	Central Railroad	3	"	"	"	6.0 - 7.5	"	"	38	-	-	-	-	-	-	-	-
42	"	1	16 + 62	10RT	473.8	1.0 - 2.5	Clay	A-7-6(38)	23	-	0.0	0.0	35.0	65.0	58	26	32
"	"	2	"	"	"	3.5 - 5.0	Silty clay	A-6	32	-	-	-	-	-	-	-	-
"	"	3	"	"	"	7.0 - 12.0	Sandstone	-	-	90	-	-	-	-	-	-	-
43	"	1	17 + 75	15LT	470.2	1.0 - 2.5	Clay	A-7-6	16	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	Silty clay	A-6	15	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	48	-	-	-	-	-	-	-	-
"	"	4	"	"	"	9.5 - 14.5	Sandstone	-	-	100	-	-	-	-	-	-	-
44	"	1	12 + 00	18LT	488.5	1.0 - 2.5	Silty clay	A-6	7	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	"	A-6(19)	23	-	0.0	0.0	63.0	27.0	38	20	18
45	SR 790 North	1	10 + 90	14RT	629.0	3.5 - 5.0	Weathered shale	-	33	-	-	-	-	-	-	-	-
"	over Richland	2	"	"	"	8.5 - 10.0	Shale	-	35-50/.2	-	-	-	-	-	-	-	-
"	Creek	3	"	"	"	10.0 - 15.0	Limestone	-	-	48	-	-	-	-	-	-	-
46	"	1	10 + 50	73RT	635.5	1.0 - 2.5	Silty clay	A-6	13	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	"	"	13	-	-	-	-	-	-	-	-
47	"	1	11 + 60	14RT	633.5	1.0 - 2.5	Sandy loam	A-4	3	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	"	"	5	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	12	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 9.5	Weathered shale	-	-	-	-	-	-	-	-	-	-
"	"	5	"	"	"	9.5 - 14.5	Limestone	-	-	60	-	-	-	-	-	-	-
"	"	6	"	"	"	14.5 - 19.5	"	-	-	62	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description: Texture	Soil Description: AASHTO	Blow per Ft.	RQD %	Grain Size Distribution: Gravel	Sand	Silt	Clay	LL	PL	PI
48	SR 790 North	1	11 + 43	14LT	633.4	1.0 - 2.5	Silty clay	A-6	6	-	-	-	-	-	-	-	-
"	over Richland	2	"	"	"	3.5 - 5.0	"	"	5	-	-	-	-	-	-	-	-
"	Creek	3	"	"	"	6.0 - 7.0	Weathered shale	-	-	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 13.5	Limestone	-	-	70	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 18.5	"	-	-	82	-	-	-	-	-	-	-
49	"	1	15 + 00	24RT	656.7	1.0 - 2.5	Loam	A-4	20	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	Silty clay	A-6(19)	27	-	0.0	6.0	63.0	31.0	40	21	19
"	"	3	"	"	"	6.0 - 7.5	"	"	20	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	17	-	-	-	-	-	-	-	-
50	"	1	12 + 16	14LT	633.8	1.0 - 2.5	Sandy loam	A-4(0)	6	-	0.0	53.0	37.0	10.0	21	16	5
"	"	2	"	"	"	3.5 - 5.0	"	"	11	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	7	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	Silty clay	A-6	51	-	-	-	-	-	-	-	-
"	"	5RC	"	"	"	10.0 - 15.0	Limestone	-	-	85	-	-	-	-	-	-	-
"	"	6RC	"	"	"	15.0 - 20.0	"	-	-	68	-	-	-	-	-	-	-
51	CR 580 East	1	13 + 98	6LT	594.3	1.0 - 2.5	Silty loam	A-4	15	-	-	-	-	-	-	-	-
"	over Richland	2	"	"	"	3.5 - 5.0	"	"	10	-	-	-	-	-	-	-	-
"	Creek	3	"	"	"	6.0 - 7.5	"	"	28	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	Weathered shale	-	38-50/.4	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	"	-	29-50/.4	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	"	-	48-50/.4	-	-	-	-	-	-	-	-
"	"	7RC	"	"	"	23.7 - 25.7	Limestone	-	-	47	-	-	-	-	-	-	-
52	"	1	14 + 29	2RT	594.1	11.5 - 12.5	Silty loam	A-4	49-50/.3	-	-	-	-	-	-	-	-
"	"	2	"	"	"	14.0 - 15.5	Weathered shale	-	64	-	-	-	-	-	-	-	-
"	"	3	"	"	"	16.5 - 17.2	"	-	34-50/.4	-	-	-	-	-	-	-	-
"	"	4	"	"	"	19.0 - 20.0	"	-	43-50/.4	-	-	-	-	-	-	-	-
53	"	1	14 + 55	15RT	585.2	3.0 - 3.5	Gravel	A-1	49-50/.2	-	-	-	-	-	-	-	-
"	"	2	"	"	"	5.5 - 6.0	Weathered shale	-	38-50/.3	-	-	-	-	-	-	-	-
"	"	3	"	"	"	8.0 - 8.5	"	-	42-50/.4	-	-	-	-	-	-	-	-
"	"	4	"	"	"	10.5 - 11.5	"	-	-	-	-	-	-	-	-	-	-
"	"	5 RC	"	"	"	16.0 - 21.0	Dolomitic limestone	-	-	45	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description: Texture	Soil Description: AASHTO	Blow per Ft.	RQD %	Grain Size Distribution: Gravel	Sand	Silt	Clay	LL	PL	PI
54	CR 580 East	1	14 + 84	19RT	591.9	1.0 - 2.5	Silty loam	A-4(3)	13	-	-	-	-	-	-	-	-
"	over Richland	2	"	"	"	3.5 - 5.0	Silty clay loam	A-4(5)	10	-	-	-	-	-	-	-	-
"	Creek	3	"	"	"	6.0 - 7.5	Sandy loam	A-4(10)	4	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	20	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 14.5	Weathered shale	-	40-50/.2	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	"	-	59	-	-	-	-	-	-	-	-
"	"	7RC	"	"	"	22.7 - 27.7	Dolomitic limestone	-	-	45	-	-	-	-	-	-	-
55	CR 540 East	1	25 + 97	20RT	526.3	1.0 - 2.5	Silty clay loam	A-4(9)	10	-	0.0	0.0	76.0	24.0	30	21	9
"	over Richland	2	"	"	"	3.5 - 5.0	"	"	11	-	-	-	-	-	-	-	-
"	Creek	3	"	"	"	6.0 - 7.5	Sandy loam	A-4	7	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	6	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	"	"	16	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	Silty clay loam	A-4	5	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	"	"	3	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	"	"	4	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.0	"	"	23-50/.4	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.0	"	"	50	-	-	-	-	-	-	-	-
"	"	11	"	"	"	43.0 - 43.5	Shale	-	-	-	-	-	-	-	-	-	-
56	"	1	26 + 00	15LT	527.8	1.0 - 2.5	Silty loam	A-6(6)	20	-	0.0	28.0	55.0	17.0	32	21	11
"	"	2	"	"	"	3.5 - 5.0	"	A-4	13	-	-	-	-	-	-	-	-
"	"	3	"	"	"	3.5 - 5.0	"	"	2	-	-	-	-	-	-	-	-
"	"	4	"	"	"	6.0 - 7.5	"	"	2	-	-	-	-	-	-	-	-
"	"	5	"	"	"	8.5 - 10.0	"	"	5	-	-	-	-	-	-	-	-
"	"	6	"	"	"	13.5 - 15.0	Sand	A-3	10	-	-	-	-	-	-	-	-
57	"	1	26 + 37	10LT	530.6	1.0 - 2.5	Silty loam	A-6	5	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	"	"	7	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	6	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	Sandy loam	A-4	5	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	"	"	-	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	Sand	A-3	15	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	Silty loam	A-6	4	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	"	"	5	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.0	"	"	7	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.0	Sandy loam	A-4(0)	19	-	7.0	45.0	28.0	20.0	32	28	4
"	"	11	"	"	"	43.0 - 43.0	"	"	19	-	-	-	-	-	-	-	-
"	"	12	"	"	"	47.0 - 48.8	Shale	-	-	-	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description: Texture	Soil Description: AASHTO	Blow per Ft.	RQD %	Grain Size Distribution: Gravel	Sand	Silt	Clay	LL	PL	PI
58	CR 540 East	1	26 + 87	20RT	526.9	1.0 - 2.5	Sandy loam	A-4	7	-	-	-	-	-	-	-	-
"	over Richland	2	"	"	"	3.5 - 5.0	"	"	9	-	-	-	-	-	-	-	-
"	Creek	3	"	"	"	6.0 - 7.5	"	"	6	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	A-4	4	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	Clay loam	A-6	23	-	-	-	-	-	-	-	-
"	"	6RC	"	"	"	15.5 - 20.5	Limestone	-	-	13	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	Silty clay loam	A-4	20	-	-	-	-	-	-	-	-
"	"	8RC	"	"	"	25.5 - 30.5	Siltstone	-	-	43	-	-	-	-	-	-	-
59	"	1	27 + 28	20LT	526.3	1.0 - 2.5	Silty clay loam	A-4	15	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	"	"	9	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	Sandy loam	"	7	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	8	-	-	-	-	-	-	-	-
"	"	5RC	"	"	"	13.5 - 15.0	Limestone	-	-	70	-	-	-	-	-	-	-
"	"	6RC	"	"	"	15.0 - 18.0	Shale	-	-	70	-	-	-	-	-	-	-
60	CR 225 North	1	15 + 20	6RT	522.2	1.0 - 1.5	Loam	A-4	8	-	-	-	-	-	-	-	-
"	over Richland	2	"	"	"	3.5 - 5.0	"	"	8	-	-	-	-	-	-	-	-
"	Creek	3	"	"	"	6.0 - 7.5	"	"	9	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	10	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	Sandy loam	A-4	7	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	"	"	8	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	"	"	13	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	Gravelly sand	A-1-b(0)	9	-	22.0	71.0	4.0	3.0	NP	NP	NP
"	"	9	"	"	"	33.5 - 35.0	"	"	13	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.0	Sandy loam	A-4	11	-	-	-	-	-	-	-	-
"	"	11	"	"	"	43.5 - 45.0	"	"	12	-	-	-	-	-	-	-	-
"	"	12	"	"	"	48.5 - 50.0	"	"	12	-	-	-	-	-	-	-	-
"	"	13	"	"	"	53.5 - 55.0	Gravelly sand	A-1-b	41-50/.5	-	-	-	-	-	-	-	-
61	"	1	15 + 76	13LT	515.3	1.0 - 2.5	Loam	A-4(0)	9	-	0.0	35.0	49.0	16.0	23	21	2
"	"	2	"	"	"	3.5 - 5.0	Silty clay loam	A-6	9	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	7	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	Loam	A-4	6	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	"	"	6	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	Sandy loam	A-4(0)	10	-	0.0	56.0	38.0	6.0	NP	NP	NP
"	"	7	"	"	"	23.5 - 25.0	"	"	18-50/.3	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	Gravelly sand	A-1-b(0)	5	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.0	Sandy loam	A-4	7	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.0	"	"	3	-	-	-	-	-	-	-	-
"	"	11	"	"	"	43.5 - 45.0	"	"	4	-	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description: Texture	Soil Description: AASHTO	Blow per Ft.	RQD %	Grain Size Distribution: Gravel	Sand	Silt	Clay	LL	PL	PI
62	CR 225 North	1	16 + 33	14RT	505.5	3.0 - 4.5	Gravelly sand	A-1-b	16	-	-	-	-	-	-	-	-
"	over Richland	2	"	"	"	5.5 - 7.0	"	"	13	-	-	-	-	-	-	-	-
"	Creek	3	"	"	"	8.0 - 9.5	"	"	23	-	-	-	-	-	-	-	-
"	"	4	"	"	"	10.5 - 12.0	"	"	18	-	-	-	-	-	-	-	-
"	"	5	"	"	"	15.5 - 17.0	Loam	A-4	33	-	-	-	-	-	-	-	-
"	"	6	"	"	"	21.5 - 22.5	Sandstone	-	-	-	-	-	-	-	-	-	-
"	"	7RC	"	"	"	22.5 - 26.0	Shale	-	-	18	-	-	-	-	-	-	-
63	"	1	16 + 96	4LT	523.5	6.0 - 7.5	Sandy loam	A-4	7	-	-	-	-	-	-	-	-
"	"	2	"	"	"	8.5 - 10.0	Loam	"	9	-	-	-	-	-	-	-	-
"	"	3	"	"	"	13.5 - 15.0	Sandy loam	"	19	-	-	-	-	-	-	-	-
"	"	4	"	"	"	19.0 - 31.0	Weathered shale	-	-	-	-	-	-	-	-	-	-
"	"	5	"	"	"	31.0 - 35.0	Shale	-	-	-	-	-	-	-	-	-	-
64	"	1	53 + 46	47LT	534.4	1.0 - 2.5	Silty loam	A-6	20	-	-	-	-	-	-	-	-
"	"	2RC	"	"	"	6.0 - 8.5	Sandstone	-	-	62	-	-	-	-	-	-	-
"	"	3RC	"	"	"	8.5 - 15.0	"	-	-	36	-	-	-	-	-	-	-
"	"	4RC	"	"	"	13.5 - 15.0	"	-	-	79	-	-	-	-	-	-	-
65	SR 157 over	1	52 + 06	31RT	524.4	5.5 - 6.0	Sandy loam	A-2-4(0)	-	-	4.9	71.0	19.3	4.8	NP	NP	NP
"	Kelly Branch	2	"	"	"	7.0 - 7.5	Silty clay loam	A-6(18)	-	-	0.0	1.5	73.4	25.1	40	24	16
"	"	3	"	"	"	9.5 - 10.0	Silty loam	A-4(5)	-	-	0.0	10.3	74.9	14.8	29	23	6
66	"	1	52 + 07	28.5RT	524.1	1.0 - 2.5	Loam	A-2-4(0)	2	-	0.0	49.9	43.5	6.7	NP	NP	NP
"	"	2	"	"	"	3.5 - 5.0	Sand loam	A-2-4	3	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	-	8	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	Silty clay loam	A-6	3	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	"	"	19	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	Sandy loam	A-2-4(0)	-	-	21.4	45.9	25.8	6.9	NP	NP	NP
"	"	7	"	"	"	23.5 - 25.0	Weathered sandstone	-	-	-	-	-	-	-	-	-	-
"	"	8RC	"	"	"	28.5 - 30.0	Sandstone	-	-	26	-	-	-	-	-	-	-
67	"	1	52 + 37	32.5LT	523.1	1.0 - 2.5	Sandy loam	A-2-4	5	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	"	"	6	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	Silty clay loam	A-6	4	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	4	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	Sandy loam	A-4(0)	3	-	10.2	52.3	27.3	10.2	19	14	5
"	"	6	"	"	"	18.5 - 20.0	"	"	27	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	Sand	A-1-b(0)	2	-	5.0	80.8	9.8	4.4	NP	NP	NP
"	"	8	"	"	"	28.5 - 30.0	"	"	34	-	-	-	-	-	-	-	-
"	"	9RC	"	"	"	31.6 - 35.6	Sandstone	-	-	63	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description: Texture	Soil Description: AASHTO	Blow per Ft.	RQD %	Grain Size Distribution: Gravel	Sand	Silt	Clay	LL	PL	PI
68	SR 157 over Kelly Branch	1	52 + 60	34.5RT	523.4	1.0 - 2.5	Sand	A-1-b	24	-	-	-	-	-	-	-	-
"		2	"	"	"	3.5 - 5.0	"	"	12	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	Silty loam	A-4(4)	2	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	8	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	"	"	4	-	0.0	23.8	62.0	14.2	30	23	7
"	"	6	"	"	"	18.5 - 20.0	Sandy loam	A-2-4	4	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	Sand	A-1-b	8	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	Sandstone	-	-	-	-	-	-	-	-	-	-
69	"	1	52 + 93	22LT	525.5	1.0 - 2.5	Silt loam	A-4	6	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	Sand	A-1-b	16	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	Silty clay loam	A-6	4	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	8	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	"	"	4	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	"	"	4	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	Sandy loam	A-4	18	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	"	"	6	-	-	-	-	-	-	-	-
"	"	9RC	"	"	"	32.8 - 37.8	Sandstone	-	-	63	-	-	-	-	-	-	-
70	"	1	55 + 30	35RT	524.8	1.0 - 2.5	Sandy loam	A-2-4	4	-	-	-	-	-	-	-	-
"	"	2	"	"	"	3.5 - 5.0	"	A-4	14	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	Silty clay loam	A-6(19)	5	-	0.0	0.6	71.3	28.1	39	21	18
"	"	4	"	"	"	8.5 - 10.0	"	"	3	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	"	"	4	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	"	"	6	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	"	"	5	-	-	-	-	-	-	-	-
71	SR 157 over West Fork of White River	1	516 + 98	22LT	506.7	1.0 - 2.5	Sandy loam	A-2-4	1	-	-	-	-	-	-	-	-
"		2	"	"	"	3.5 - 5.0	"	"	6	-	-	-	-	-	-	-	-
"		3	"	"	"	6.0 - 7.5	"	"	4	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	4	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	Sand	A-3	6	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	Sandy gravel	A-1-a	6	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	"	"	23	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	Sand	A-3	54	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.0	"	"	35	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.0	"	"	30	-	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description: Texture	Soil Description: AASHTO	Blow per Ft.	RQD %	Grain Size Distribution: Gravel	Sand	Silt	Clay	LL	PL	PI
72	SR 157 over	1	518 + 52	20RT	504.0	1.0 - 2.5	Sandy loam	A-2-4(0)	5	-	0.2	77.1	16.2	3.1	NP	NP	NP
"	West Fork of	2	"	"	"	3.5 - 5.0	"	"	4	-	-	-	-	-	-	-	-
"	White River	3	"	"	"	6.0 - 7.5	"	"	5	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	8	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	Gravel	A-1	8	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	Sandy gravel	A-1-0	8	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	"	"	29	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	Sand	A-3	32	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.0	"	"	30	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.0	"	"	26	-	-	-	-	-	-	-	-
"	"	11	"	"	"	43.5 - 45.0	"	"	34	-	-	-	-	-	-	-	-
"	"	12	"	"	"	48.5 - 50.0	"	"	51	-	-	-	-	-	-	-	-
73	"	1	522 + 16	22RT	507.8	1.0 - 2.5	Sandy loam	A-2-4(0)	5	-	0.2	64.8	26.9	2.8	NP	NP	NP
"	"	2	"	"	"	3.5 - 5.0	"	"	5	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	5	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	Silty clay loam	A-7	8	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	Silt loam	A-4(3)	2	-	1.5	25.4	55.2	7.5	25	17	8
"	"	6	"	"	"	18.5 - 20.0	Sandy gravel	A-1-a0	9	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	"	"	21	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	"	"	29	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.0	"	"	43	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.0	"	"	48	-	52.1	43.8	2.1	2.0	NP	NP	NP
"	"	11	"	"	"	43.5 - 45.0	"	"	19	-	-	-	-	-	-	-	-
"	"	12	"	"	"	48.5 - 50.0	"	"	42	-	-	-	-	-	-	-	-
"	"	13	"	"	"	53.5 - 55.0	"	"	26	-	-	-	-	-	-	-	-
74	SR 67 over	1	623 + 55	15RT	494.3	1.0 - 2.5	Silty clay	A-6(14)	10	-	0.0	7.0	55.0	36.0	38	24	14
"	Hick Ditch	2	"	"	"	3.5 - 5.0	"	A-6	6	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	7	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	7	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	"	"	6	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	"	"	9	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	Sand	A-3(0)	20	-	0.0	91.0	4.5	4.5	NP	NP	NP
"	"	8	"	"	"	28.5 - 30.0	"	"	17	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.0	Silt	A-4(0)	19	-	0.0	3.0	81.0	16.0	NP	NP	NP
"	"	10	"	"	"	38.5 - 40.0	Silty clay	A-6	21	-	-	-	-	-	-	-	-
"	"	11	"	"	"	43.5 - 45.0	"	"	14	-	-	-	-	-	-	-	-
"	"	12	"	"	"	48.5 - 50.0	"	"	16	-	-	-	-	-	-	-	-
"	"	13	"	"	"	53.5 - 55.0	"	"	18	-	-	-	-	-	-	-	-

APPENDIX A (CONTINUED)

Boring No.	Project	Sample No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description		Blow per Ft.	RQD %	Grain Size Distribution				LL	PL	PI
							Texture	AASHTO			Gravel	Sand	Silt	Clay			
75	SR 67 over	1	623 + 87	20LT	484.6	1.0 - 2.5	Silty clay	A-6	9	-	-	-	-	-	-	-	-
"	Hick Ditch	2	"	"	"	3.5 - 5.0	"	"	11	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	8	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	6	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	"	"	15	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	Sand	A-3	26	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	Silty clay	A-6	15	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	"	"	17	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.0	"	"	9	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.0	"	"	11	-	-	-	-	-	-	-	-
"	"	11	"	"	"	43.5 - 45.0	"	"	12	-	-	-	-	-	-	-	-
"	"	12	"	"	"	48.5 - 50.0	"	"	17	-	-	-	-	-	-	-	-
"	"	13	"	"	"	53.5 - 55.0	Gravelly sand	A-2-4(0)	86	-	27.0	61.0	6.0	6.0	NP	NP	NP
"	"	14	"	"	"	58.5 - 60.0	"	"	99	-	-	-	-	-	-	-	-
"	"	15	"	"	"	63.5 - 65.0	Silty clay	A-6	28	-	-	-	-	-	-	-	-
"	"	16	"	"	"	68.5 - 70.0	Gravelly sand	A-3(0)	25	-	30.0	61.0	4.5	4.5	NP	NP	NP
"	"	17	"	"	"	73.5 - 75.0	Silty clay	A-6	86	-	-	-	-	-	-	-	-
76	SR 67 over	1	624 + 34	18RT	492.1	1.0 - 2.5	Silty clay	A-6	6	-	-	-	-	-	-	-	-
"	Hick Ditch	2	"	"	"	3.5 - 5.0	"	"	7	-	-	-	-	-	-	-	-
"	"	3	"	"	"	6.0 - 7.5	"	"	6	-	-	-	-	-	-	-	-
"	"	4	"	"	"	8.5 - 10.0	"	"	7	-	-	-	-	-	-	-	-
"	"	5	"	"	"	13.5 - 15.0	"	"	7	-	-	-	-	-	-	-	-
"	"	6	"	"	"	18.5 - 20.0	"	"	10	-	-	-	-	-	-	-	-
"	"	7	"	"	"	23.5 - 25.0	Sand	A-3	14	-	-	-	-	-	-	-	-
"	"	8	"	"	"	28.5 - 30.0	Silty clay	A-6	18	-	-	-	-	-	-	-	-
"	"	9	"	"	"	33.5 - 35.0	"	"	12	-	-	-	-	-	-	-	-
"	"	10	"	"	"	38.5 - 40.0	"	"	12	-	-	-	-	-	-	-	-
"	"	11	"	"	"	43.5 - 45.0	"	"	14	-	-	-	-	-	-	-	-
"	"	12	"	"	"	48.5 - 50.0	"	"	18	-	-	-	-	-	-	-	-
"	"	13	"	"	"	53.5 - 55.0	"	"	18	-	-	-	-	-	-	-	-

APPENDIX B

PHYSICAL AND CHEMICAL PROPERTIES OF AGRICULTURAL SOILS IN GREENE COUNTY (2)

APPENDIX B. PHYSICAL AND CHEMICAL PROPERTIES OF AGRICULTURAL SOILS IN GREENE COUNTY (2).

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
AlB2, AlC2------- Alford	0-6	12-26	1.25-1.40	0.6-2.0	0.22-0.24	3.6-7.3	Low-----------	0.37	5	5	.5-2
	6-61	22-30	1.35-1.50	0.6-2.0	0.18-0.20	3.6-6.0	Moderate-----	0.37			
	61-80	8-20	1.30-1.45	0.6-2.0	0.20-0.22	4.5-7.3	Low-----------	0.37			
AnB*, AnC*:											
Alvin-----------	0-12	5-10	1.50-1.70	6.0-20	0.10-0.12	5.1-6.5	Low-----------	0.17	5	2	.5-1
	12-27	12-22	1.45-1.65	0.6-6.0	0.12-0.20	4.5-6.5	Low-----------	0.24			
	27-60	3-10	1.55-1.75	2.0-6.0	0.05-0.13	5.1-7.8	Low-----------	0.24			
Bloomfield------	0-32	2-10	1.60-1.80	6.0-20	0.07-0.09	5.1-7.3	Low-----------	0.15	5	1	.5-2
	32-60	2-10	1.60-1.80	6.0-20	0.06-0.11	5.1-7.3	Low-----------	0.15			
	60-80	5-13	1.60-1.80	2.0-20	0.05-0.10	5.1-7.8	Low-----------	0.15			
Ao--------------- Ambraw	0-14	20-27	1.40-1.60	0.6-2.0	0.14-0.20	5.6-7.3	Moderate-----	0.28	5	5	2-3
	14-51	20-35	1.45-1.65	0.2-2.0	0.15-0.19	5.1-7.3	Moderate-----	0.28			
	51-60	18-30	1.50-1.70	0.2-2.0	0.11-0.22	5.6-8.4	Low-----------	0.28			
Ar--------------- Armiesburg	0-16	20-27	1.30-1.45	0.6-2.0	0.21-0.24	6.1-7.3	Moderate-----	0.28	5	6	2-4
	16-60	25-35	1.30-1.45	0.6-2.0	0.18-0.20	6.1-7.8	Moderate-----	0.28			
AvB2------------- Ava	0-7	20-27	1.30-1.50	0.6-2.0	0.20-0.23	4.5-7.3	Low-----------	0.43	4	6	.5-2
	7-17	22-33	1.40-1.60	0.6-2.0	0.18-0.21	4.5-6.0	Moderate-----	0.43			
	17-29	24-35	1.50-1.70	0.2-0.6	0.18-0.21	4.5-5.5	Moderate-----	0.43			
	29-53	20-30	1.65-1.80	<0.06	0.09-0.11	4.5-5.5	Low-----------	0.43			
	53-80	20-30	1.55-1.75	0.2-0.6	0.15-0.18	4.5-6.0	Low-----------	0.43			
Ay--------------- Ayrshire	0-16	5-12	1.35-1.50	0.6-2.0	0.13-0.20	5.6-7.3	Low-----------	0.24	5	3	.5-2
	16-43	22-32	1.40-1.55	0.6-2.0	0.16-0.18	5.1-7.3	Low-----------	0.32			
	43-54	8-20	1.45-1.60	0.6-2.0	0.12-0.14	5.1-7.3	Low-----------	0.32			
	54-70	4-10	1.40-1.60	2.0-6.0	0.06-0.08	6.6-8.4	Low-----------	0.20			
Bb--------------- Bartle	0-8	15-26	1.30-1.45	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.43	4	5	1-3
	8-27	22-35	1.40-1.60	0.6-2.0	0.20-0.22	4.5-6.5	Low-----------	0.43			
	27-52	22-35	1.60-1.80	<0.06	0.06-0.08	4.5-5.5	Low-----------	0.43			
	52-60	22-35	1.40-1.60	0.2-0.6	0.15-0.18	5.1-7.3	Low-----------	0.43			
BcF*:											
Berks-----------	0-3	5-23	1.20-1.50	0.6-6.0	0.08-0.12	3.6-6.5	Low-----------	0.17	3	8	.5-3
	3-23	5-27	1.20-1.60	0.6-6.0	0.04-0.10	3.6-6.5	Low-----------	0.17			
	23	---	---	---	---	---	-------------	----			
Ebal------------	0-6	20-27	1.35-1.50	0.6-2.0	0.22-0.24	4.5-6.5	Low-----------	0.37	3	5	.5-2
	6-19	20-30	1.40-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Moderate-----	0.28			
	19-33	40-50	1.45-1.65	0.2-0.6	0.06-0.09	4.5-6.0	Moderate-----	0.28			
	33-54	40-70	1.55-1.75	<0.06	0.07-0.10	4.5-6.0	High---------	0.28			
	54-60	---	---	---	---	---	-------------	----			

APPENDIX B (CONTINUED)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
BfG*:											
Berks	0-3	5-23	1.20-1.50	0.6-6.0	0.08-0.12	3.6-6.5	Low	0.17	3	8	.5-3
	3-23	5-27	1.20-1.60	0.6-6.0	0.04-0.10	3.6-6.5	Low	0.17			
	23	---	---	---	---	---	-------------	----			
Rock outcrop.											
BlE, BlG	0-9	5-10	1.50-1.70	6.0-20	0.07-0.12	5.1-7.8	Low	0.15	5	2	.5-2
Bloomfield	9-32	2-10	1.60-1.80	6.0-20	0.06-0.11	5.1-7.3	Low	0.15			
	32-80	5-13	1.60-1.80	2.0-20	0.05-0.10	5.1-7.8	Low	0.15			
Bo	0-8	18-27	1.20-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.43	5	6	1-3
Bonnie	8-39	18-27	1.40-1.60	0.2-0.6	0.20-0.22	4.5-5.5	Low	0.43			
	39-60	18-30	1.45-1.65	0.2-0.6	0.18-0.20	4.5-7.8	Low	0.43			
Br	0-12	40-70	1.30-1.50	<0.06	0.11-0.14	5.6-7.3	Very high	0.28	5	4	1-3
Booker	12-60	60-80	1.30-1.60	<0.06	0.09-0.11	5.6-7.8	Very high	0.28			
Bs	0-12	40-70	0.80-1.20	0.2-0.6	0.20-0.25	5.6-7.3	Very high	0.28	5	4	10-2
Booker	12-60	60-80	1.30-1.60	<0.06	0.09-0.11	5.6-7.8	Very high	0.28			
CcE2, CcF	0-5	12-24	1.30-1.50	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.32	5	5	1-3
Chetwynd	5-33	18-25	1.40-1.60	0.6-2.0	0.13-0.17	4.5-5.5	Moderate	0.32			
	33-80	18-25	1.35-1.60	0.6-2.0	0.11-0.17	4.5-6.0	Low	0.32			
CfC2, CfC3, CfD2, CfD3	0-8	15-25	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.37	4-3	6	1-3
Cincinnati	8-22	22-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	Low	0.37			
	22-46	24-35	1.60-1.85	0.06-0.6	0.08-0.12	4.5-6.5	Moderate	0.37			
	46-80	24-40	1.55-1.75	0.06-0.6	0.08-0.12	4.5-6.5	Moderate	0.37			
ChC2	0-6	15-25	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.37	4	6	1-3
Cincinnati	6-21	20-35	1.45-1.65	0.6-2.0	0.15-0.22	4.5-6.0	Moderate	0.43			
	21-52	20-35	1.60-1.85	0.06-0.6	0.06-0.08	4.5-5.5	Moderate	0.43			
	52-74	24-40	1.55-1.75	0.06-0.6	0.12-0.14	4.5-6.5	Moderate	0.32			
	74-80	8-15	1.55-1.75	2.0-6.0	0.04-0.05	4.5-5.5	Low	0.20			
	80	---	---	---	---	---	-------------	----			
Cu	0-25	15-25	1.30-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.37	5	5	1-3
Cuba	25-60	14-20	1.45-1.65	0.6-2.0	0.17-0.21	4.5-5.5	Low	0.37			
EcD*:											
Ebal	0-6	20-27	1.35-1.50	0.6-2.0	0.22-0.24	4.5-6.5	Low	0.37	3	5	.5-2
	6-19	20-30	1.40-1.60	0.6-2.0	0.12-0.22	4.5-6.0	Moderate	0.28			
	19-33	40-50	1.45-1.65	0.2-0.6	0.06-0.12	4.5-6.0	Moderate	0.28			
	33-54	40-70	1.55-1.75	<0.06	0.07-0.12	4.5-6.0	High	0.28			
	54-60	---	---	---	---	---	-------------	----			
Gilpin	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-7.3	Low	0.32	3	6	.5-4
	8-22	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low	0.24			
	22-48	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low	0.24			
	48	---	---	---	---	---	-------------	----			
EfD2*:											
Ebal	0-6	20-27	1.35-1.50	0.6-2.0	0.22-0.24	4.5-6.5	Low	0.37	3	5	.5-2
	6-19	20-30	1.40-1.60	0.6-2.0	0.12-0.22	4.5-6.0	Moderate	0.28			
	19-33	40-50	1.45-1.65	0.2-0.6	0.06-0.12	4.5-6.0	Moderate	0.28			
	33-54	40-70	1.55-1.75	<0.06	0.07-0.12	4.5-6.0	High	0.28			
	54-60	---	---	---	---	---	-------------	----			

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
HaE2 Hagerstown	0-6	15-27	1.20-1.40	0.6-6.0	0.16-0.24	4.5-6.5	Low	0.32	4	6	1-5
	6-26	23-40	1.20-1.60	0.6-2.0	0.10-0.24	4.5-7.3	Moderate	0.28			
	26-58	40-60	1.20-1.60	0.6-2.0	0.08-0.24	4.5-7.3	Moderate	0.28			
	58	---	---	---	---	---	---	---			
Hb, Hc Haymond	0-9	10-18	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.37	5	5	1-3
	9-40	10-18	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.37			
	40-60	10-18	1.30-1.45	0.6-2.0	0.20-0.22	6.1-7.3	Low	0.37			
HdA Henshaw	0-11	12-27	1.20-1.40	0.6-2.0	0.18-0.23	5.6-7.3	Low	0.43	4	6	.5-2
	11-54	18-34	1.20-1.40	0.2-0.6	0.15-0.19	5.1-8.4	Low	0.43			
	54-60	15-34	1.20-1.40	0.2-0.6	0.17-0.22	6.6-8.4	Low	0.43			
HeD2, HeE, HeG Hickory	0-9	19-25	1.30-1.50	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.37	5	6	1-2
	9-56	20-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-6.0	Moderate	0.37			
	56-80	15-32	1.50-1.70	0.6-2.0	0.11-0.19	5.1-8.4	Low	0.37			
MbB2 Markland	0-9	28-40	1.35-1.50	0.2-0.6	0.18-0.23	5.1-7.3	Moderate	0.43	2	7	1-3
	9-36	35-55	1.55-1.70	0.06-0.2	0.11-0.16	5.1-8.4	High	0.32			
	36-60	24-50	1.55-1.70	0.06-0.2	0.09-0.11	7.4-8.4	High	0.32			
MgA McGary	0-11	22-27	1.35-1.50	0.6-2.0	0.22-0.24	6.6-7.3	Low	0.43	3	5	1-4
	11-39	35-50	1.60-1.75	<0.2	0.11-0.13	5.6-7.8	High	0.32			
	39-60	35-50	1.60-1.75	<0.2	0.14-0.16	7.9-8.4	High	0.32			
Mo Montgomery	0-15	35-48	1.35-1.55	0.2-0.6	0.12-0.23	6.1-7.8	High	0.37	5	7	3-6
	15-38	35-55	1.45-1.65	0.06-0.2	0.11-0.18	6.1-8.4	High	0.37			
	38-60	35-48	1.50-1.70	0.06-0.2	0.18-0.20	7.4-8.4	Moderate	0.37			
Mu Muskego	0-19	2-4	0.10-0.21	0.6-6.0	0.35-0.45	5.6-7.3	---	---	2	2	>50
	19-60	18-35	0.30-1.10	0.06-0.2	0.18-0.24	6.6-8.4	Moderate	0.28			
Ne Newark	0-10	7-27	1.20-1.40	0.6-2.0	0.15-0.24	5.6-7.8	Low	0.43	5	5	1-4
	10-32	9-35	1.20-1.45	0.6-2.0	0.18-0.23	5.6-7.8	Low	0.43			
	32-60	8-40	1.30-1.50	0.6-2.0	0.15-0.22	5.6-7.8	Low	0.43			
No, Nr Nolin	0-8	12-27	1.20-1.40	0.6-2.0	0.18-0.23	5.6-8.4	Low	0.43	5	5	2-4
	8-48	18-35	1.25-1.50	0.6-2.0	0.18-0.23	5.6-8.4	Low	0.43			
	48-60	10-30	1.30-1.55	0.6-6.0	0.10-0.23	5.1-8.4	Low	0.43			
PbC2, PbD2 Parke	0-8	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-6.5	Low	0.37	5	5	.5-2
	8-31	22-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.5	Moderate	0.37			
	31-80	18-30	1.55-1.65	0.6-2.0	0.16-0.18	4.5-5.5	Low	0.28			
Pc Patton	0-16	27-35	1.15-1.35	0.6-2.0	0.21-0.23	6.6-7.3	Moderate	0.28	5	7	3-5
	16-60	27-40	1.25-1.45	0.2-0.6	0.18-0.20	6.1-7.8	Moderate	0.28			
PdB2 Pekin	0-10	15-26	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.43	4	5	1-3
	10-24	25-35	1.40-1.60	0.6-2.0	0.20-0.22	4.5-5.5	Low	0.43			
	24-52	22-30	1.60-1.80	<0.06	0.06-0.08	4.5-5.5	Low	0.43			
	52-60	20-34	1.40-1.60	0.6-2.0	0.06-0.08	4.5-7.3	Low	0.43			
Pf Peoga	0-16	15-26	1.30-1.45	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.43	4	5	1-3
	16-56	22-34	1.40-1.60	0.06-0.2	0.18-0.20	4.5-6.0	Moderate	0.43			
	56-60	20-34	1.40-1.60	0.06-0.2	0.19-0.21	4.5-6.5	Low	0.43			
Pg Piankeshaw	0-6	15-25	1.20-1.40	0.6-2.0	0.14-0.20	6.1-7.3	Low	0.37	5	5	1-2
	6-26	18-25	1.20-1.40	0.6-2.0	0.09-0.18	6.1-7.3	Low	0.37			
	26-60	15-20	1.40-1.60	0.6-2.0	0.04-0.15	6.1-7.3	Low	0.37			

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
PkB2, PkC2------- Pike	0-9	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.37	5	5	.5-2
	9-44	22-35	1.30-1.45	0.6-2.0	0.18-0.22	4.5-6.0	Low-----------	0.37			
	44-66	18-35	1.30-1.45	0.6-2.0	0.12-0.18	4.5-5.5	Low-----------	0.37			
	66-80	10-22	1.45-1.65	2.0-6.0	0.05-0.17	4.5-8.4	Low-----------	0.37			
PrB, PrC--------- Princeton	0-11	12-20	1.35-1.50	0.6-2.0	0.13-0.18	5.6-7.3	Low-----------	0.24	5	3	.5-2
	11-51	18-25	1.40-1.55	0.6-2.0	0.16-0.18	5.1-6.5	Low-----------	0.32			
	51-64	8-18	1.40-1.55	2.0-6.0	0.12-0.14	5.1-7.3	Low-----------	0.32			
	64-70	4-10	1.45-1.60	2.0-6.0	0.06-0.08	5.6-8.4	Low-----------	0.17			
RaA-------------- Reesville	0-13	12-20	1.20-1.45	0.6-2.0	0.17-0.24	5.1-7.3	Low-----------	0.37	5	5	2-4
	13-44	27-35	1.30-1.55	0.6-2.0	0.17-0.22	5.1-7.8	Moderate------	0.37			
	44-60	20-25	1.30-1.60	0.6-2.0	0.15-0.20	7.4-8.4	Low-----------	0.37			
Rb--------------- Rensselaer	0-15	9-20	1.20-1.40	0.6-2.0	0.13-0.15	6.1-7.8	Low-----------	0.24	5	3	2-8
	15-59	18-35	1.40-1.60	0.6-2.0	0.15-0.20	6.1-7.8	Moderate------	0.32			
	59-70	8-20	1.50-1.70	0.6-2.0	0.10-0.18	7.4-8.4	Low-----------	0.43			
Rd--------------- Rensselaer	0-15	11-27	1.30-1.45	0.6-2.0	0.20-0.24	6.1-7.3	Low-----------	0.32	5	5	2-8
	15-59	18-35	1.40-1.60	0.6-2.0	0.15-0.20	6.1-7.8	Moderate------	0.32			
	59-70	8-20	1.50-1.70	0.6-2.0	0.10-0.18	7.4-8.4	Low-----------	0.43			
RmA-------------- Roby	0-10	5-15	1.20-1.40	0.6-2.0	0.10-0.15	4.5-6.0	Low-----------	0.20	4	3	1-2
	10-64	10-22	1.40-1.70	0.6-2.0	0.12-0.19	5.6-7.8	Low-----------	0.28			
	64-80	3-15	1.50-1.85	2.0-6.0	0.04-0.17	5.6-7.8	Low-----------	0.10			
ScA-------------- Shakamak	0-10	18-27	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.43	4	5	1-2
	10-28	24-32	1.35-1.50	0.2-0.6	0.18-0.22	4.5-6.0	Moderate------	0.43			
	28-57	18-22	1.60-1.80	<0.06	0.06-0.08	4.5-5.5	Low-----------	0.43			
	57-80	12-30	1.40-1.60	0.2-0.6	0.06-0.19	4.5-5.5	Low-----------	0.43			
So, Sr----------- Steff	0-10	12-25	1.30-1.50	0.6-2.0	0.15-0.24	4.5-7.3	Low-----------	0.43	5	5	1-2
	10-27	12-34	1.30-1.55	0.6-2.0	0.18-0.23	4.5-5.5	Low-----------	0.43			
	27-60	10-25	1.40-1.65	0.6-6.0	0.08-0.21	4.5-5.5	Low-----------	0.43			
St--------------- Stendal	0-8	18-27	1.30-1.45	0.6-2.0	0.22-0.24	4.5-6.5	Low-----------	0.37	5	5	1-3
	8-60	18-35	1.45-1.65	0.6-2.0	0.20-0.22	4.5-6.0	Low-----------	0.37			
Ud. Udorthents											
UnE-------------- Uniontown	0-6	12-20	1.20-1.40	0.6-2.0	0.19-0.33	5.1-7.3	Low-----------	0.43	4	5	.5-2
	6-45	18-35	1.20-1.40	0.6-2.0	0.18-0.22	5.1-7.8	Low-----------	0.37			
	45-60	10-30	1.20-1.40	0.2-2.0	0.18-0.22	6.6-8.4	Low-----------	0.37			
VgA-------------- Vigo	0-8	10-16	1.30-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.43	3	5	.5-2
	8-18	12-24	1.35-1.50	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	0.43			
	18-80	24-35	1.40-1.55	<0.06	0.18-0.22	4.5-5.5	Moderate------	0.43			
WcA-------------- Waupecan	0-11	15-27	1.15-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	4	6	4-5
	11-28	25-35	1.30-1.50	0.6-2.0	0.18-0.22	5.1-7.3	Moderate------	0.43			
	28-48	10-30	1.55-1.75	2.0-6.0	0.08-0.18	5.1-7.3	Low-----------	0.10			
	48-80	3-10	1.60-1.80	>20	0.02-0.04	5.1-8.4	Low-----------	0.10			
WeD2, WeD3, WgD2- Wellston	0-5	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-7.3	Low-----------	0.37	4	6	1-3
	5-27	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low-----------	0.37			
	27-53	15-30	1.30-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low-----------	0.37			
	53	---	---	---	---	---	--------------	----			

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
EfD2*:											
Wellston	0-5	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-7.3	Low	0.37	4	6	1-3
	5-27	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low	0.37			
	27-53	15-27	1.30-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low	0.37			
	53	---	---	---	---	---	---	---			
EnA	0-16	8-15	1.30-1.55	2.0-6.0	0.12-0.22	5.1-7.3	Low	0.28	4	5	2-6
Elston	16-30	10-22	1.35-1.60	2.0-6.0	0.12-0.18	6.1-7.3	Low	0.20			
	30-53	4-10	1.45-1.65	2.0-6.0	0.08-0.13	6.1-7.3	Low	0.20			
	53-60	1-5	1.60-1.75	>20	0.05-0.07	5.6-8.4	Low	0.15			
Ev	0-11	20-26	1.30-1.45	0.6-2.0	0.20-0.24	6.1-7.3	Low	0.37	5	5	1-3
Evansville	11-50	25-34	1.40-1.55	0.6-2.0	0.18-0.20	4.5-5.5	Moderate	0.37			
	50-60	25-34	1.40-1.55	0.6-2.0	0.19-0.21	5.6-8.4	Low	0.37			
FaB	0-16	18-27	1.60-1.80	0.06-0.2	0.06-0.15	5.6-7.3	Low	0.43	3	6	.5-2
Fairpoint	16-60	18-35	1.60-1.80	0.2-0.6	0.03-0.10	5.6-7.3	Moderate	0.32			
FcC, FcE	0-3	27-35	1.45-1.65	0.2-0.6	0.06-0.15	5.6-7.3	Moderate	0.37	5	6	<.5
Fairpoint	3-60	18-35	1.60-1.80	0.2-0.6	0.03-0.10	5.6-7.3	Moderate	0.37			
FcG	0-3	18-27	1.40-1.55	0.6-2.0	0.09-0.18	5.6-7.3	Low	0.37	5	6	<.5
Fairpoint	3-60	18-35	1.60-1.80	0.2-0.6	0.03-0.10	5.6-7.3	Moderate	0.37			
GcE2	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-7.3	Low	0.32	3	6	.5-4
Gilpin	8-22	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low	0.24			
	22-34	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low	0.24			
	34	---	---	---	---	---	---	---			
GfF*:											
Gilpin	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-7.3	Low	0.32	3	6	.5-4
	8-22	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low	0.24			
	22-34	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low	0.24			
	34	---	---	---	---	---	---	---			
Berks	0-3	5-23	1.20-1.50	0.6-6.0	0.12-0.17	3.6-6.5	Low	0.24	3	5	.5-3
	3-23	5-27	1.20-1.60	0.6-6.0	0.04-0.10	3.6-6.5	Low	0.17			
	23	---	---	---	---	---	---	---			
GgE*:											
Gilpin	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-7.3	Low	0.32	3	6	.5-4
	8-22	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low	0.24			
	22-42	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low	0.24			
	42	---	---	---	---	---	---	---			
Ebal	0-6	20-27	1.35-1.50	0.6-2.0	0.22-0.24	4.5-6.5	Low	0.37	3	5	.5-2
	6-19	20-30	1.40-1.60	0.6-2.0	0.12-0.22	4.5-6.0	Moderate	0.28			
	19-33	40-50	1.45-1.65	0.2-0.6	0.06-0.12	4.5-6.0	Moderate	0.28			
	33-54	40-70	1.55-1.75	<0.06	0.07-0.12	4.5-6.0	High	0.28			
	54-60	---	---	---	---	---	---	---			
GmE*:											
Gilpin	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-7.3	Low	0.32	3	6	.5-4
	8-22	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low	0.24			
	22-49	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low	0.24			
	49	---	---	---	---	---	---	---			
Wellston	0-5	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-7.3	Low	0.37	4	6	1-3
	5-27	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low	0.37			
	27-53	15-30	1.30-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low	0.37			
	53	---	---	---	---	---	---	---			

APPENDIX B (CONTINUED)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Wm------ Wilhite	0-10	40-50	1.40-1.45	0.2-0.6	0.12-0.14	5.1-7,3	High------	0.32	5	4	1-3
	10-32	35-45	1.40-1.65	<0.06	0.08-0.18	5.1-6.5	Moderate------	0.32			
	32-60	35-50	1.40-1.65	<0.06	0.08-0.20	5.1-7.3	High------	0.32			
Wt------ Wirt	0-10	8-18	1.25-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Low------	0.37	5	5	.5-3
	10-27	8-18	1.20-1.55	0.6-2.0	0.15-0.20	5.6-7.3	Low------	0.24			
	27-60	5-18	1.20-1.60	2.0-6.0	0.07-0.17	5.6-7.3	Low------	0.24			
ZaA, ZaB2, ZaC2, ZaC3------ Zanesville	0-8	12-27	1.35-1.40	0.6-2.0	0.19-0.23	4.5-7.3	Low------	0.43	3	5	1-2
	8-23	18-35	1.35-1.45	0.6-2.0	0.17-0.22	4.5-5.5	Low------	0.37			
	23-54	18-33	1.50-1.75	0.06-0.6	0.08-0.12	4.5-5.5	Low------	0.37			
	54-60	20-40	1.50-1.70	0.2-2.0	0.08-0.12	4.5-5.5	Low------	0.28			
Zp------ Zipp	0-7	40-50	1.40-1.55	0.2-2.0	0.12-0.21	6.1-7.3	High------	0.28	5	4	1-3
	7-47	35-55	1.55-1.70	<0.2	0.11-0.13	4.5-6.0	High------	0.28			
	47-60	35-50	1.55-1.70	<0.2	0.08-0.10	6.6-8.4	High------	0.28			

APPENDIX C

ENGINEERING INDEX PROPERTIES OF AGRICULTURAL SOILS IN GREENE COUNTY (2)

APPENDIX C. ENGINEERING INDEX PROPERTIES OF AGRICULTURAL SOILS IN GREENE COUNTY (2).

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AlE2, AlC2-------Alford	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	20-30	5-15
	6-61	Silty clay loam, silt loam.	CL	A-6, A-4	0	100	100	90-100	80-100	25-35	8-15
	61-80	Silt loam, silt	ML, CL-ML, CL	A-4	0	100	100	90-100	70-100	<25	NP-10
AnB*, AnC*:											
Alvin-----------	0-12	Loamy sand-------	SM	A-2	0	100	100	50-75	15-30	<20	NP-4
	12-27	Very fine sandy loam, sandy loam, sandy clay loam.	SM, SC, CL, ML	A-2, A-4, A-6	0	100	100	90-100	20-80	15-38	NP-13
	27-60	Stratified sandy loam to sand.	SM, SP, SP-SM	A-2, A-3	0-5	95-100	90-100	70-95	4-35	<20	NP-4
Bloomfield------	0-32	Sand, loamy sand	SM, SP, SP-SM	A-2-4, A-3	0	100	100	60-90	4-20	---	NP
	32-60	Loamy sand, loamy fine sand, sand.	SP, SM, SP-SM	A-2-4, A-3	0	100	100	70-90	4-35	---	NP
	60-80	Fine sand, loamy fine sand, sand.	SM, SP, SP-SM	A-2-4, A-3	0	100	100	65-90	4-35	<20	NP-3
Ao---------------Ambraw	0-14	Sandy clay loam	CL	A-6	0	100	100	85-95	60-90	30-40	10-20
	14-51	Clay loam, sandy clay loam.	CL	A-7, A-6	0	100	100	85-95	50-85	30-50	10-25
	51-60	Stratified silty clay loam to sandy loam.	SC, ML, CL, SM	A-6, A-4	0	100	90-100	80-90	40-80	20-40	NP-17
Ar---------------Armiesburg	0-16	Silt loam--------	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	20-35
	16-60	Silty clay loam, loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	20-35
AvB2-------------Ava	0-7	Silt loam--------	CL	A-6, A-4	0	100	100	95-100	90-100	25-35	8-15
	7-17	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	25-45	10-20
	17-29	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	25-45	10-20
	29-53	Silty clay loam, loam, clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	90-100	80-90	20-45	5-20
	53-80	Loam, silt loam, clay loam.	CL	A-4, A-6	0	100	95-100	90-100	80-90	25-40	7-20
Ay---------------Ayrshire	0-16	Sandy loam-------	CL, CL-ML, SC, SM-SC	A-4, A-6	0	100	95-100	60-85	40-60	20-30	5-15
	16-43	Sandy clay loam, loam, clay loam.	SC, CL	A-6	0	100	95-100	80-90	35-55	25-35	10-15
	43-54	Sandy loam-------	SC, SM-SC	A-4, A-6, A-2-4, A-2-6	0	100	95-100	60-70	30-40	15-25	5-15
	54-70	Stratified silt to fine sand.	SM, ML, CL-ML, SM-SC	A-2-4, A-4	0	100	95-100	65-90	20-55	<20	NP-5

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Bb------------------ Bartle	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-90	20-35	5-15
	8-27	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	27-52	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
	52-60	Silty clay loam, silt loam, clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
BcF*:											
Berks-----------	0-3	Channery silt loam.	GM, ML, GC, SC	A-2, A-4	0-30	50-80	45-75	40-60	30-55	25-36	5-10
	3-23	Channery loam, very channery loam, channery silt loam.	GM, SM, GC, SC	A-1, A-2, A-4	0-30	40-80	35-70	25-60	20-45	25-36	5-10
	23	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ebal------------	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-100	70-90	25-35	5-15
	6-19	Silt loam, channery silt loam, channery silty clay loam.	CL, GC	A-6, A-7	0-3	60-70	50-70	45-70	40-65	30-45	12-20
	19-33	Channery silty clay, clay.	CL, CH, GC	A-7	3-15	60-70	50-70	45-70	40-65	40-55	20-30
	33-54	Clay, silty clay	CH	A-7	0-3	95-100	90-100	80-100	70-95	60-75	35-45
	54-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BfG*:											
Berks-----------	0-3	Channery loam----	GM, ML, GC, SC	A-2, A-4	0-30	50-80	45-75	40-60	30-55	25-36	5-10
	3-23	Channery loam, very channery loam, channery silt loam.	GM, SM, GC, SC	A-1, A-2, A-4	0-30	40-80	35-70	25-60	20-45	25-36	5-10
	23	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
BlE, BlG--------- Bloomfield	0-9	Sand-------------	SM, SP, SP-SM	A-2-4, A-3	0	100	100	70-90	4-35	---	NP
	9-32	Fine sand, loamy fine sand, sand.	SP, SM, SP-SM	A-2-4, A-3	0	100	100	70-90	4-35	---	NP
	32-80	Fine sand, loamy fine sand, sand.	SM, SP, SP-SM	A-2-4, A-3	0	100	100	65-90	4-35	<20	NP-3
Bo--------------- Bonnie	0-8	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	27-34	8-12
	8-39	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	27-34	8-12
	39-60	Silt loam, silty clay loam, loam.	CL	A-4, A-6	0	100	100	90-100	80-100	25-39	8-15
Br--------------- Booker	0-12	Clay-------------	CL, CH	A-7	0	100	100	95-100	95-100	45-75	30-45
	12-60	Clay, silty clay	CH	A-7	0	100	100	100	95-100	65-85	40-55
Bs--------------- Booker	0-12	Mucky clay-------	CL, CH	A-7	0	100	100	95-100	80-95	45-75	30-45
	12-60	Clay, silty clay	CH	A-7	0	100	100	100	95-100	65-85	40-55
CcE2, CcF-------- Chetwynd	0-5	Silt loam--------	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-95	60-95	22-33	4-12
	5-33	Sandy clay loam, loam.	SC, CL	A-4, A-6	0	90-100	85-100	70-95	40-75	20-35	8-18
	33-80	Sandy loam, loam, sandy clay loam.	SM-SC, SC, CL-ML, CL	A-2-4, A-2-6, A-4, A-6	0	76-95	65-95	60-90	30-65	20-32	5-15

APPENDIX C (CONTINUED)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
CfC2, CfC3, CfD2, CfD3------------ Cincinnati	0-8	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	80-100	25-40	3-16
	8-22	Silty clay loam, silt loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-100	25-40	8-15
	22-46	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	95-100	85-95	75-90	65-80	25-40	6-20
	46-80	Clay loam, loam, silt loam.	CL, ML, CL-ML	A-6, A-4	0	95-100	85-95	75-90	65-80	25-40	5-20
ChC2------------- Cincinnati	0-6	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	80-100	25-40	3-16
	6-21	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-100	25-40	8-15
	21-52	Clay loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	95-100	85-95	75-90	65-80	25-40	6-20
	52-74	Channery clay loam, loam.	CL, ML, SM, SC	A-6, A-4	0	70-100	70-95	55-90	35-80	25-40	5-20
	74-80	Extremely channery sandy loam.	SM, SM-SC	A-6, A-4	0	15-25	15-25	10-20	5-20	<25	NP-5
	80	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Cu--------------- Cuba	0-25	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	95-100	90-100	70-90	25-35	3-12
	25-60	Stratified silt loam to sandy loam.	CL, ML, CL-ML	A-4	0	100	80-100	75-100	50-85	15-30	2-10
EcD*: Ebal------------	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-100	70-90	25-35	5-15
	6-19	Silt loam, channery silt loam, channery silty clay loam.	CL, GC	A-6, A-7	0-3	60-70	50-70	45-70	40-65	30-45	12-20
	19-33	Channery silty clay, silty clay, clay.	CL, CH, GC	A-7	3-15	60-70	50-70	45-70	40-65	40-55	20-30
	33-54	Clay, silty clay	CH	A-7	0-3	95-100	90-100	80-100	70-95	60-75	35-45
	54-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Gilpin-----------	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	8-22	Channery loam, silt loam, clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	22-48	Channery loam, very channery loam, channery silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
EfD2*: Ebal------------	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-100	70-90	25-35	5-15
	6-19	Silt loam, channery silt loam, channery silty clay loam.	CL, GC	A-6, A-7	0-3	60-95	50-95	45-70	40-65	30-45	12-20
	19-33	Channery silty clay, silty clay, clay.	CL, CH, GC	A-7	3-15	60-95	50-95	45-70	40-65	40-55	20-30
	33-54	Clay, silty clay	CH	A-7	0-3	95-100	90-100	80-100	70-95	60-75	35-45
	54-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
EfD2*:											
Wellston--------	0-5	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	5-27	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	27-53	Silt loam, channery loam, channery silt loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	53	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
EnA-------------- Elston	0-16	Loam-------------	CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	20-35	5-15
	16-30	Sandy loam, loam, sandy clay loam.	SM, SM-SC, ML, CL-ML		0	95-100	75-95	50-80	35-65	<25	NP-7
	30-53	Loamy sand, sandy loam, gravelly sandy loam.	SP-SM, SM	A-2-4, A-3, A-1-b	0-3	95-100	75-95	45-75	5-30	<20	NP
	53-60	Sand, gravelly coarse sand.	SP-SM, SM	A-3, A-2-4, A-1-b	0-3	95-100	70-95	40-70	5-25	---	NP
Ev--------------- Evansville	0-11	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-98	25-40	3-15
	11-50	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-98	35-55	20-35
	50-60	Stratified silt loam to silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-98	30-45	10-25
FaB-------------- Fairpoint	0-16	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	90-100	80-100	70-100	50-90	20-40	4-18
	16-60	Shaly to extremely shaly silt loam to clay loam.	GC, CL, CL-ML, SC	A-4, A-6, A-7, A-2	15-30	55-75	25-65	20-65	15-60	25-50	4-24
FcC, FcE--------- Fairpoint	0-3	Shaly clay loam	CL, SC, GC	A-6, A-7	5-20	55-90	45-85	40-85	35-80	35-50	12-24
	3-60	Shaly to extremely shaly silt loam to clay loam.	GC, CL, CL-ML, SC	A-4, A-6, A-7, A-2	15-30	55-75	25-65	20-65	15-60	25-50	4-24
FcG-------------- Fairpoint	0-3	Very shaly loam	CL, CL-ML, SC, GC	A-4, A-6, A-2	5-15	55-90	45-85	40-85	30-75	20-40	4-18
	3-60	Shaly to extremely shaly silt loam to clay loam.	GC, CL, CL-ML, SC	A-4, A-6, A-7, A-2	15-30	55-75	25-65	20-65	15-60	25-50	4-24
GcE2------------- Gilpin	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	8-22	Channery loam, shaly silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	22-34	Channery loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
GfF*:											
Gilpin----------	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	8-22	Loam, silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	22-34	Channery loam, very channery loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Berks-----------	0-3	Loam------------	CL, ML, CL-ML	A-4	0-10	80-100	75-100	65-85	50-75	25-36	5-10
	3-23	Channery loam, very channery loam, channery silt loam.	GM, SM, GC, SC	A-1, A-2, A-4	0-30	40-80	35-70	25-60	20-45	25-36	5-10
	23	Weathered bedrock	---	---	---	---	---	---	---	---	---
GgE*:											
Gilpin----------	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	8-22	Loam, silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	22-42	Channery loam, very channery loam, very channery silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	42	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ebal------------	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-100	70-90	25-35	5-15
	6-19	Silt loam, channery silt loam, channery silty clay loam.	CL, GC	A-6, A-7	0-3	60-70	50-70	45-70	40-65	30-45	12-20
	19-33	Channery silty clay, silty clay, clay.	CL, CH, GC	A-7	3-15	60-70	50-70	45-70	40-65	40-55	20-30
	33-54	Clay, silty clay	CH	A-7	0-3	95-100	90-100	80-100	70-95	60-75	35-45
	54-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
GmE*:											
Gilpin----------	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	8-22	Loam, silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	22-49	Channery loam, very channery loam, very channery silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	49	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Wellston--------	0-5	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	5-27	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	27-53	Silt loam, channery loam, channery silty clay loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	53	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
HaE2------------- Hagerstown	0-6	Silt loam--------	CL, CL-ML	A-4, A-6, A-7	0-15	85-100	80-100	80-100	70-95	25-50	5-25
	6-26	Silt loam, silty clay loam, loam.	CL, CH	A-7	0-5	90-100	80-100	75-100	55-95	48-65	26-34
	26-58	Clay, silty clay	CH, CL	A-7, A-6	0-5	85-100	80-100	75-100	75-95	30-70	15-40
	58	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Hb, Hc----------- Haymond	0-9	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	9-40	Silt loam, loam	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	40-60	Fine sandy loam, silt loam, loam.	ML, SM	A-4	0	95-100	90-100	80-100	35-90	27-36	4-10
HdA-------------- Henshaw	0-11	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	90-100	80-100	20-35	3-10
	11-54	Silty clay loam, silt loam.	CL	A-6, A-4	0	95-100	95-100	95-100	85-100	30-40	8-18
	54-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	75-100	25-40	5-15
HeD2, HeE-------- Hickory	0-9	Silt loam--------	CL	A-6, A-4	0-5	95-100	90-100	90-100	75-95	20-35	8-15
	9-56	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	80-95	65-80	30-50	15-30
	56-80	Clay loam, sandy loam, sandy clay loam.	CL-ML, CL	A-4, A-6	0-5	85-100	80-95	80-95	60-80	20-40	5-20
HeG-------------- Hickory	0-9	Loam-------------	CL	A-6, A-4	0-5	95-100	90-100	90-100	75-95	20-35	8-15
	9-56	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0-5	95-100	90-100	80-95	65-80	30-50	15-30
	56-80	Clay loam, sandy clay loam, loam.	CL-ML, CL	A-4, A-6	0-5	85-100	80-95	80-95	60-80	20-40	5-20
Mb82------------- Markland	0-9	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	30-45	10-20
	9-36	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-95	45-60	19-32
	36-60	Stratified clay to silt loam.	CL, CH, ML, MH	A-7	0	100	100	90-100	75-95	40-55	15-25
MgA-------------- McGary	0-11	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-40	5-15
	11-39	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-100	45-60	25-35
	39-60	Stratified silty clay loam to clay.	CL, CH	A-6, A-7	0	95-100	95-100	95-100	85-100	35-55	20-35
Mo--------------- Montgomery	0-15	Silty clay loam, silty clay.	CL	A-7	0	100	100	100	85-100	40-50	20-30
	15-38	Silty clay loam, silty clay.	CH	A-7	0	100	100	95-100	90-100	50-65	30-42
	38-60	Stratified clay to silty clay loam.	CL, CH	A-7	0	100	100	90-100	85-100	40-55	20-32
Mu--------------- Muskego	0-19	Sapric material	PT	A-8	0	---	---	---	---	---	---
	19-60	Coprogenous earth	OL	A-5	0	95-100	95-100	85-100	75-96	41-50	2-8
Ne--------------- Newark	0-10	Loam-------------	ML, CL, CL-ML	A-4	0	95-100	90-100	80-100	55-95	<32	NP-10
	10-32	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	95-100	90-100	85-100	70-98	22-42	3-20
	32-60	Silt loam, silty clay loam, loam.	ML, CL, CL-ML	A-4, A-6, A-7	0-3	75-100	70-100	65-100	55-95	22-42	3-20

APPENDIX C (CONTINUED)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
No, Nr------------ Nolin	0-8	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-100	25-40	5-18
	8-48	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	75-100	25-46	5-23
	48-60	Loam, silt loam, fine sandy loam.	ML, CL, CL-ML, SM	A-4, A-6	0-10	50-100	50-100	40-95	35-95	<30	NP-15
PbC2, PbD2-------- Parke	0-8	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	70-100	20-35	7-15
	8-31	Silty clay loam, silt loam, clay loam.	CL	A-6, A-4	0	95-100	95-100	90-100	80-100	25-40	7-15
	31-80	Sandy clay loam, loam, sandy loam.	SC, CL	A-2, A-6, A-4	0-3	90-100	85-95	55-90	30-60	25-35	7-15
Pc---------------- Patton	0-16	Silty clay loam	CL	A-6	0	100	100	95-100	75-95	30-40	15-25
	16-60	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	95-100	80-100	40-55	15-25
PdB2-------------- Pekin	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-100	20-30	5-15
	10-24	Silt loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-100	25-40	10-20
	24-52	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	88-98	65-90	25-35	5-15
	52-60	Stratified silt loam and silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	80-95	50-85	20-40	5-15
Pf---------------- Peoga	0-16	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	16-56	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	20-30
	56-60	Stratified silty clay loam and silt loam.	CL, ML	A-6, A-7	0	100	100	90-100	70-95	35-50	10-25
Pg---------------- Piankeshaw	0-6	Silt loam--------	CL, CL-ML	A-4	0-10	95-100	80-95	75-85	55-75	20-30	5-10
	6-26	Loam, channery loam.	CL, SC	A-4, A-6	5-15	75-95	55-90	50-90	45-75	25-30	8-12
	26-60	Channery loam, very channery loam.	SC, GC, GM-GC, SM-SC	A-2-4, A-1-b	10-30	55-80	55-75	35-55	20-35	<25	5-8
PkB2, PkC2-------- Pike	0-9	Silt loam--------	CL	A-4, A-6	0	100	100	90-100	80-95	25-35	8-15
	9-44	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	85-100	80-90	30-45	10-25
	44-66	Loam, silt loam, sandy clay loam.	CL, SC	A-6, A-2-6	0	80-90	70-90	60-90	30-80	20-35	10-20
	66-80	Stratified sand to sandy clay loam.	CL-ML, ML, SM, SM-SC	A-4, A-2-4, A-1	0	70-90	65-85	35-70	15-65	<20	NP-5
PrB, PrC---------- Princeton	0-11	Fine sandy loam	SM, SC, ML, CL	A-4, A-2-4	0	100	100	60-85	30-55	<25	NP-10
	11-51	Sandy clay loam, fine sandy loam, very fine sandy loam.	SC, CL	A-6	0	100	100	70-90	35-70	25-35	10-15
	51-64	Stratified loamy fine sand to loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-2-4, A-2-6	0	100	100	60-90	30-70	15-25	5-15
	64-70	Stratified fine sand to silt.	SM, ML, CL-ML, SM-SC	A-2-4, A-4	0	100	100	65-90	20-55	<20	NP-5

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
RaA: Reesville	0-13	Silt loam	ML, CL-ML	A-4	0	100	90-100	90-100	85-100	25-35	4-10
	13-44	Silty clay loam	CL, CL-ML	A-6, A-7, A-4	0	100	90-100	90-100	90-100	20-50	4-28
	44-60	Silt loam	CL, CL-ML	A-4, A-6	0	100	90-100	85-100	80-90	20-40	4-20
Rb: Rensselaer	0-15	Sandy loam	SM, SM-SC	A-2-4, A-4	0	95-100	90-100	80-100	30-50	<25	NP-6
	15-59	Clay loam, sandy loam, sandy clay loam.	CL	A-6, A-4	0	95-100	90-100	80-100	50-95	25-40	8-20
	59-70	Stratified fine sand to silt loam.	CL, SC, ML, SM	A-4, A-2	0	95-100	90-100	45-95	25-85	<25	2-10
Rd: Rensselaer	0-15	Loam	CL, ML, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	15-35	4-15
	15-59	Clay loam, sandy loam, sandy clay loam.	CL	A-6, A-4	0	95-100	90-100	80-100	50-95	25-40	8-20
	59-70	Stratified fine sand to silt loam.	CL, SC, ML, SM	A-4, A-2	0	95-100	90-100	45-95	25-85	<25	2-10
RmA: Roby	0-10	Sandy loam	SM, SM-SC	A-4	0	95-100	95-100	85-95	35-50	<25	NP-7
	10-64	Sandy loam, sandy clay loam, loamy sand.	SM, ML	A-4, A-2	0	90-100	90-100	85-95	30-75	20-34	NP-7
	64-80	Stratified sand to sandy loam.	SM, SM-SC, SP-SM, ML	A-4, A-2	0	80-100	75-90	50-90	10-65	<20	NP-7
ScA: Shakamak	0-10	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	20-30	5-15
	10-28	Silt loam, silty clay loam.	CL	A-6	0	100	100	90-100	85-100	25-35	10-20
	28-57	Silt loam	CL, CL-ML	A-4	0	100	100	85-100	70-100	20-30	5-10
	57-80	Loam, clay loam	CL, CL-ML	A-4, A-6	0	95-100	85-100	75-95	60-80	20-35	5-15
So, Sr: Steff	0-10	Silt loam	ML	A-4	0	95-100	90-100	80-100	55-95	<35	NP-10
	10-27	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	70-95	20-40	3-20
	27-60	Silt loam, loam, fine sandy loam.	ML, CL-ML, SM	A-4, A-2, A-1	0-10	50-100	40-100	35-95	20-90	<35	NP-10
St: Stendal	0-8	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-90	25-40	5-15
	8-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-90	25-40	5-15
Ud. Udorthents											
UnE: Uniontown	0-6	Silt loam	ML, CL-ML, CL	A-4	0	100	95-100	90-100	80-100	20-35	2-10
	6-45	Silt loam, silty clay loam.	CL, ML	A-6, A-4, A-7	0	100	95-100	90-100	85-100	30-45	7-20
	45-60	Silt loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	90-100	90-100	85-100	75-100	30-45	7-20

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
VgA---------------- Vigo	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-95	25-35	5-15
	8-18	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-95	25-35	5-15
	18-80	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	95-100	90-100	80-95	35-55	20-40
WcA---------------- Waupecan	0-11	Silt loam--------	CL	A-4, A-6	0	100	100	90-100	85-95	20-35	8-15
	11-28	Silty clay loam, silt loam, clay loam.	CL	A-6, A-7	0	100	100	95-100	85-95	35-45	15-25
	28-48	Stratified clay loam to gravelly loamy sand.	SM, SC, ML, CL	A-2, A-4	0	90-100	65-90	50-70	25-65	<20	NP-10
	48-80	Sand and gravel, very gravelly sandy loam.	GP, SP, SP-SM, GP-GM	A-1	10-35	40-95	30-85	30-50	0-15	---	NP
WeD2, WeD3, WgD2- Wellston	0-5	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	5-27	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	27-53	Silt loam, channery loam, channery silty clay loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	53	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Wm---------------- Wilhite	0-10	Silty clay-------	CH, CL, ML, MH	A-7	0	100	100	95-100	90-95	40-55	15-25
	10-32	Silty clay, silty clay loam, clay loam.	CL, ML	A-6, A-7	0	100	100	95-100	85-95	35-50	12-21
	32-60	Silty clay, clay, silty clay loam.	CH, CL	A-6, A-7	0	100	100	90-100	80-95	35-60	12-30
Wt---------------- Wirt	0-10	Very fine sandy loam.	CL-ML, ML	A-4	0	95-100	90-100	80-100	65-90	<25	3-7
	10-27	Silt loam, loam, fine sandy loam.	CL-ML, ML	A-4	0	95-100	90-100	75-100	55-90	<25	3-7
	27-60	Stratified loam to gravelly sandy loam.	SM, SM-SC, ML, CL-ML	A-4, A-2, A-1-b	0	85-100	50-100	40-95	20-75	<25	NP-7
ZaA, ZaB2, ZaC2, ZaC3------------- Zanesville	0-8	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	8-23	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	23-54	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	54-60	Silty clay loam, silt loam, channery silty clay loam.	SC, CL, SM, GM	A-6, A-4, A-2, A-1-b	0-10	65-100	50-100	40-100	20-85	20-40	2-20
Zp---------------- Zipp	0-7	Silty clay-------	CL, CH	A-7, A-6	0	100	100	95-100	90-95	35-55	20-30
	7-47	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-95	45-60	25-35
	47-60	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	100	90-100	75-95	45-60	25-35

APPENDIX D

STATISTICAL STREAM FLOW DATA FOR THE WHITE RIVER (7)

APPENDIX D. STATISTICAL STREAM FLOW DATA FOR THE WHITE RIVER (7).

03360500 White River at Newberry, Ind.

LOCATION.--Lat 38°55'42", long 87°01'00", in NE¼NE¼ sec.25, T.6 N., R.6 W., Greene County, on right bank 500 ft (152 m) upstream from bridge on State Highway 57 at Newberry, 2.3 miles (3.7 km) downstream from Doans Creek, and at mile 118.0 (189.9 km).

DRAINAGE AREA.--4,688 mi^2 (12,142 km^2).

REMARKS.--Flow slightly regulated by upstream reservoirs.

DURATION TABLE OF DAILY DISCHARGE FOR YEAR ENDING SEPTEMBER 30

CLASS	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	
YEAR	NUMBER OF DAYS IN CLASS																																			CFS-DAYS
1929								5	13	16	23	17	23	12	15	28	25	18	15	26	21	25	11	16	7	7	12	9	11	8	2					2417315.0
1930					18	30	18	24	8	11	16	26	12	10	19	19	16	20	15	19	17	18	7	6	2	5	2	9	6	1	2	2	6	1		1975712.0
1931					30	74	38	35	30	26	22	10	25	13	22	8	8	8	9	2			4	1												455747.0
1932								12	20	37	38	15	15	19	25	21	12	32	21	17	14	14	15	10	7	5	1	6	2	6	2					1693757.0
1933								22	19	20	19	7	14	12	11	19	9	18	30	22	21	15	20	21	7	17	9	9	10	6	4	1	3			2719266.0
1934					4	5	9	22	75	56	52	29	27	13	19	11	6	10	8	5	4	4	3	1	2											601983.0
1935						17	22	24	27	34	44	19	28	17	12	25	18	16	10	8	6	10	4	6	3	4	1	4	3	3						1114729.0
1936			16	12	26	31	29	14	15	26	33	20	18	14	16	16	10	18	10	7	5	10	7	4	1	2	2	1	3							853846.0
1937							5	5	15	44	23	25	12	17	17	15	13	21	24	22	10	18	15	7	8	14	14	4	4	2	4	4	1	2		2357419.0
1938									8	16	26	18	23	32	34	17	19	22	14	18	19	10	10	11	10	13	6	16	4	8	6	5				2570027.0
1939					4	14	4	46	14	15	28	11	18	28	22	16	20	21	19	11	11	11	5	11	5	7	3	4	6	3	4	3	1			1797714.0
1940			12	12	44	52	48	15	20	11	18	13	7	9	14	20	16	13	4	11	13	2	3		2		2		3	2						762079.0
1941		9	43	19	33	27	22	46	63	32	16	15	7	5	6	5	3	3	3	1	1		3	3												349847.0
1942		3		1		6	4	3	10	24	60	24	23	14	15	18	21	17	22	16	17	17	8	9	9	10	4	3	5	2						1591844.0
1943						1	21	12	13	18	8	15	19	24	34	44	28	24	20	14	17	8	8	8	2	4	3	1	6	3	3	3	1	2	1	1927408.0
1944					6	20	76	56	37	15	16	8	16	4	5	5	4	14	15	14	14	8	6	4	2	4	4	1	4	2	2	2	2			1280122.0
1945			1	29	56	43	4	1	10	17	3	3	8	8	20	22	11	12	23	17	11	5	7	13	5	8	5	10	5	3	3	1	1			1737928.0
1946						7	15	8	8	8	9	8	28	30	18	42	22	17	19	20	21	18	20	13	11	13	6	4								1752146.0
1947					3	14	13	9	15	9	14	15	25	26	26	17	18	23	17	22	18	23	12	9	7	4	9	13	4							1810613.0
1948								17	40	45	29	18	31	25	20	11	10	20	12	16	15	9	11	4	5	5	3	3	7	6	1	2				1618539.0
1949						3	9	4	15	21	24	15	14	22	21	19	26	36	18	23	17	10	15	7	5	7	4	5	9	12	1	3				2207945.0
1950								5	18	26	21	14	21	11	10	16	21	16	15	26	19	24	21	16	7	6	2	12	8	5	10	10	2	2	1	3194475.0
1951								8	22	14	20	12	11	13	16	30	20	21	20	19	35	23	25	9	9	7	11	10	7	3						2189216.0
1952							4	17	17	20	18	9	9	14	24	22	11	19	27	18	21	16	20	14	16	14	9	17	10							2368305.0
1953						4	28	37	22	10	6	14	29	20	27	23	22	24	25	17	14	11	10	11	2	4		3	2							1231334.0
1954				11	38	93	31	25	14	6	21	15	20	14	23	15	6	11	7	10	2	1	2													477127.0
1955				8	11	12	31	37	12	10	18	14	22	17	24	28	15	13	23	24	8	6	12	11	7	2										1067363.0
1956						2	7-	5	6	11	19	34	17	20	19	21	23	20	19	25	43	27	6	10	7	9	4	7	3	1	1					1864458.0
1957					19	25	14	3	2	7	26	6	22	19	7	16	28	22	13	8	18	26	19	12	16	10	3	6	4	5	4	4	1			2268663.0
1958									3	3	10	12	5	22	28	40	27	36	35	26	25	19	15	19	7	4	7	3	6	5	4	4				2400800.0
1959						2	8	2	18	8	20	39	29	21	21	16	9	8	16	30	28	22	19	25	7	2	1	3	5	4	2					1894099.0
1960							11	11	8	9	31	24	12	17	28	30	32	30	30	34	21	10	7	5	3	3	4	3	1	2						1454294.0
1961						14	51	50	21	17	14	17	23	14	16	10	5	3	9	11	16	16	10	8	4	5	8	7	7	3	2		2	2		1797008.0
1962									24	14	16	11	27	35	30	37	20	22	15	27	25	22	7	7	6	7	5	6	2							1614395.0
1963						6	16	5	9	31	100	31	33	18	21	10	13	5	5	12	8	5	6	10	1	3	3	3	6	1	2	1	1			1298800.0
1964					21	86	29	18	20	19	22	16	22	9	14	6	3	2	10	15	9	10	5	4	3	4	4	2	5	3	1	2	2			1298567.0
1965					28	29	22	22	28	24	14	14	14	9	24	22	21	20	13	10	10	7	6	8	13	3	1	3								1086821.0
1966					16	13	14	24	49	45	32	30	21	12	25	19	12	16	11	8	4	3	4	2	4	1										701489.0
967					1	18	22	28	15	21	22	13	9	9	15	20	16	13	24	27	15	15	20	6	12	14	2	1	2	2	2	1				1711867.0
1968							7	4	12	36	23	10	17	9	46	21	12	18	25	21	26	13	17	13	7	4	5	4	4	4	5		2	1		2082028.0
1969								3	32	8	9	10	16	15	27	45	29	26	29	22	22	13	9	7	6	13	8	9		1	2		3	1		2075904.0
1970								3	16	20	21	24	24	24	25	28	12	28	27	29	14	16	12	12	9	9	6	2	4							1666380.0
1971								8	23	14	37	52	44	21	31	24	21	10	9	16	10	9	14	5	3	3	4	2	1	4						1276604.0
1972								24	36	20	23	12	17	18	35	30	28	28	15	14	12	12	11	1	6	11	3	6	4							1456210.0
1973											10	10	10	21	13	15	22	22	24	27	34	27	28	30	18	15	14	19	6							2819710.0

CLASS	CFS	TOTAL	ACCUM	PERCT	CLASS	CFS	TOTAL	ACCUM	PERCT	CLASS	CFS	TOTAL	ACCUM	PERCT	CLASS	CFS	TOTAL	ACCUM	PERCT
0	0.00	0	16436	100.0	9	830.00	894	13001	79.1	18	4100.0	774	5195	31.6	27	20000	230	677	4.1
1	200.00	12	16436	100.0	10	990.00	1074	12107	73.7	19	4900.0	787	4421	26.9	28	24000	179	447	2.7
2	240.00	72	16424	99.9	11	1200.00	774	11033	67.1	20	5900.0	711	3634	22.1	29	29000	110	268	1.6
3	290.00	92	16352	99.5	12	1400.00	867	10259	62.4	21	7000.0	588	2923	17.8	30	35000	69	158	.9
4	340.00	358	16260	98.9	13	1700.00	756	9392	57.1	22	8300.0	499	2335	14.2	31	41000	48	89	.5
5	410.00	648	15902	96.8	14	2000.00	940	8636	52.5	23	10000.0	409	1836	11.2	32	49000	28	41	.2
6	490.00	632	15254	92.8	15	2400.00	942	7696	46.8	24	12000.0	274	1427	8.7	33	59000	11	13	
7	580.00	719	14622	89.0	16	2900.00	743	6754	41.1	25	14000.0	282	1153	7.0	34	70000	2	2	
8	690.00	902	13903	84.6	17	3400.00	816	6011	36.6	26	17000.0	194	871	5.3					

LOWEST MEAN DISCHARGE, IN CFS, AND RANKING, FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING MARCH 31

YEAR	1	3	7	14	30	60	90	120	183	ANNUAL
1930	570.00 27	575.00 27	584.00 26	606.00 25	632.00 24	799.00 25	1010.00 30	1350.00 32	3000.00 39	8120.00 44
1931	355.00 7	358.00 7	367.00 8	380.00 8	391.00 7	417.00 6	445.00 5	446.00 3	470.00 3	1310.00 1
1932	388.00 15	411.00 16	441.00 17	472.00 15	537.00 19	909.00 32	1130.00 33	1170.00 27	1480.00 24	4360.00 25
1933	587.00 28	603.00 30	633.00 30	702.00 33	1040.00 39	1450.00 39	1850.00 39	1920.00 38	2150.00 36	5280.00 29
1934	605.00 31	631.00 32	641.00 31	647.00 29	675.00 29	856.00 30	965.00 27	987.00 21	1100.00 15	4090.00 20
1935	374.00 12	381.00 14	414.00 15	480.00 18	535.00 18	670.00 18	779.00 17	919.00 18	1080.00 14	1760.00 2
1936	425.00 17	432.00 17	437.00 16	475.00 16	505.00 16	589.00 15	766.00 16	933.00 19	1130.00 16	3590.00 13
1937	251.00 3	251.00 3	255.00 3	268.00 3	320.00 3	355.00 2	416.00 3	481.00 7	932.00 13	5290.00 30
1938	718.00 39	736.00 38	812.00 40	891.00 40	1200.00 42	1750.00 41	1920.00 40	2030.00 39	2340.00 37	5670.00 32
1939	587.00 29	587.00 28	597.00 27	614.00 27	627.00 23	698.00 20	894.00 22	1090.00 25	1610.00 29	6250.00 35
1940	351.00 6	355.00 6	360.00 7	370.00 7	390.00 6	459.00 11	480.00 10	473.00 6	652.00 7	2700.00 8

APPENDIX D (CONTINUED)

WHITE RIVER AT NEWBERRY, IND. (Continued)

LOWEST MEAN DISCHARGE, IN CFS, AND RANKING, FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING MARCH 31

YEAR	1	3	7	14	30	60	90	120	183	ANNUAL
1941	238.00 2	241.00 2	247.00 2	253.00 2	257.00 1	283.00 1	324.00 1	345.00 1	459.00 2	1780.00 3
1942	200.00 1	205.00 1	211.00 1	232.00 1	304.00 2	396.00 5	454.00 7	529.00 9	904.00 12	2800.00 9
1943	482.00 20	490.00 21	504.00 21	507.00 19	542.00 20	665.00 17	884.00 21	1000.00 23	1960.00 31	4180.00 22
1944	494.00 22	499.00 22	509.00 22	516.00 20	531.00 17	735.00 22	703.00 15	762.00 14	868.00 11	4400.00 26
1945	280.00 4	293.00 4	304.00 5	315.00 5	337.00 5	377.00 3	377.00 2	382.00 2	431.00 1	3640.00 16
1946	742.00 40	747.00 39	775.00 38	814.00 39	885.00 36	1760.00 42	2230.00 42	2850.00 42	3230.00 41	6590.00 38
1947	408.00 16	408.00 15	412.00 14	430.00 14	465.00 13	509.00 12	591.00 13	762.00 15	1220.00 19	3340.00 11
1948	646.00 35	649.00 35	662.00 33	692.00 31	813.00 32	837.00 29	875.00 20	998.00 22	1530.00 25	5430.00 31
1949	486.00 21	486.00 20	494.00 19	520.00 21	657.00 27	797.00 24	930.00 26	1510.00 34	1990.00 33	7120.00 41
1950	640.00 34	648.00 34	687.00 34	767.00 36	940.00 37	1310.00 37	1340.00 36	1530.00 35	1710.00 30	7630.00 42
1951	714.00 38	756.00 40	788.00 39	813.00 38	948.00 38	1690.00 40	2480.00 44	2230.00 40	3040.00 40	6520.00 37
1952	557.00 25	559.00 25	576.00 25	621.00 28	644.00 25	712.00 21	868.00 19	1330.00 31	2090.00 34	6020.00 34
1953	560.00 26	564.00 26	571.00 24	586.00 24	596.00 22	691.00 19	903.00 23	955.00 20	1240.00 20	4090.00 21
1954	374.00 13	380.00 13	384.00 12	389.00 11	402.00 8	421.00 7	458.00 8	462.00 5	646.00 6	2130.00 4
1955	295.00 5	298.00 5	301.00 4	307.00 4	324.00 4	395.00 4	451.00 6	536.00 10	583.00 4	.2320.00 5
1956	359.00 9	368.00 10	374.00 9	393.00 12	472.00 14	742.00 23	1340.00 37	1680.00 36	2150.00 35	4220.00 23
1957	374.00 14	376.00 12	379.00 11	386.00 9	420.00 10	450.00 9	549.00 12	684.00 13	1140.00 17	3600.00 14
1958	750.00 41	763.00 41	847.00 41	999.00 42	1150.00 41	1330.00 38	1640.00 38	2240.00 41	5230.00 44	7940.00 43
1959	1150.00 44	1200.00 44	1240.00 44	1270.00 44	1390.00 43	1790.00 43	2220.00 41	2900.00 43	3950.00 43	6950.00 40
1960	465.00 19	481.00 19	502.00 20	579.00 23	658.00 28	815.00 27	1040.00 31	1200.00 28	1550.00 28	3890.00 18
1961	444.00 18	446.00 18	465.00 18	480.00 17	496.00 15	543.00 14	599.00 14	614.00 12	709.00 9	3520.00 12
1962	635.00 33	635.00 33	656.00 32	699.00 32	820.00 34	940.00 33	977.00 28	1210.00 29	1530.00 26	5900.00 33
1963	860.00 42	860.00 42	869.00 42	952.00 41	1060.00 40	1220.00 36	1230.00 34	1270.00 30	1540.00 27	3970.00 19
1964	360.00 10	360.00 8	360.00 6	367.00 6	404.00 9	445.00 8	445.00 4	457.00 4	586.00 5	2680.00 7
1965	358.00 8	368.00 9	374.00 10	387.00 10	446.00 12	455.00 10	474.00 9	486.00 8	663.00 8	3640.00 15
1966	526.00 24	549.00 24	616.00 29	679.00 30	763.00 31	807.00 26	921.00 24	1080.00 24	1250.00 21	2620.00 6
1967	367.00 11	371.00 11	391.00 13	403.00 13	423.00 11	517.00 13	547.00 11	581.00 11	837.00 10	3830.00 17
1968	500.00 23	502.00 23	513.00 23	525.00 22	561.00 21	660.00 16	786.00 18	872.00 16	1140.00 18	4550.00 27
1969	677.00 36	695.00 36	710.00 36	733.00 34	746.00 30	825.00 28	997.00 29	1450.00 33	1980.00 32	6310.00 36
1970	1050.00 43	1070.00 43	1130.00 43	1230.00 43	1480.00 44	1830.00 44	2450.00 43	3280.00 44	3280.00 42	4940.00 28
1971	616.00 32	629.00 31	691.00 35	737.00 35	819.00 33	962.00 34	1080.00 32	1140.00 26	1260.00 22	4230.00 24
1972	593.00 30	603.00 29	607.00 28	610.00 26	648.00 26	858.00 31	926.00 25	908.00 17	1390.00 23	2850.00 10
1973	695.00 37	724.00 37	754.00 37	774.00 37	867.00 35	1040.00 35	1300.00 35	1830.00 37	2480.00 38	6810.00 39

HIGHEST MEAN DISCHARGE, IN CFS, AND RANKING, FOR THE FOLLOWING NUMBER OF [illegible]SECUTIVE DAYS IN YEAR ENDING SEPTEMBER 30

YEAR	1	3	7	15	30	60	90	[illegible]	183	ANNUAL
1929	37800.0 20	34900.0 21	31900.0 21	23700.0 20	17200.0 19	13400.0 [illegible]	11700.0 16	[illegible] 14	10900.0 4	6620.0 5
1930	59300.0 7	57900.0 6	54900.0 2	43700.0 2	28200.0 4	19100.0 5	15900.0 3	1320[illegible] 7	9810.0 10	5410.0 14
1931	10600.0 44	9810.0 44	5830.0 45	3730.0 45	3040.0 45	2680.0 44	2200.0 44	2060.0 44	1770.0 44	1250.0 44
1932	37000.0 21	35200.0 20	32900.0 20	27500.0 12	18700.0 13	14200.0 18	11600.0 17	9650.0 20	7300.0 23	4630.0 24
1933	55600.0 9	53100.0 8	42500.0 7	28600.0 11	19500.0 12	18700.0 6	16300.0 2	13800.0 3	12600.0 2	7450.0 3
1934	13400.0 42	12600.0 42	10200.0 41	6710.0 41	5330.0 41	3840.0 41	2920.0 43	2480.0 43	2120.0 43	1650.0 42
1935	32300.0 25	30900.0 25	27700.0 24	21900.0 23	14000.0 29	9200.0 32	7290.0 36	6690.0 34	5110.0 36	3050.0 36
1936	27100.0 34	25800.0 34	21200.0 34	13100.0 38	9300.0 39	7880.0 37	6590.0 38	5310.0 39	4000.0 39	2330.0 39
1937	61100.0 6	58800.0 5	51300.0 4	42400.0 4	30300.0 2	20000.0 3	15500.0 7	13700.0 4	10700.0 7	6460.0 8
1938	46000.0 17	42800.0 17	34800.0 17	33800.0 5	29000.0 3	21000.0 2	15600.0 5	13700.0 5	10800.0 6	7040.0 4
1939	49300.0 14	48200.0 11	40900.0 10	26300.0 15	16100.0 22	15000.0 13	14200.0 9	11800.0 10	8660.0 16	4930.0 19
1940	31800.0 27	30100.0 27	26100.0 26	16800.0 31	11500.0 34	7250.0 40	5620.0 40	4970.0 40	3720.0 40	2080.0 40
1941	11200.0 43	10100.0 43	9340.0 43	6590.0 42	4160.0 44	2430.0 45	2130.0 45	1780.0 45	1440.0 45	958.0 45
1942	31500.0 28	30400.0 26	25700.0 27	15900.0 32	12700.0 31	10600.0 27	9920.0 26	8550.0 25	7190.0 24	4360.0 28
1943	76000.0 1	69200.0 1	53100.0 3	43700.0 3	27200.0 5	15700.0 9	13300.0 11	10900.0 15	8590.0 17	5280.0 15
1944	52600.0 11	49500.0 10	41900.0 9	29200.0 9	21000.0 11	14200.0 19	11300.0 21	9210.0 23	6350.0 31	3500.0 34
1945	49800.0 13	44900.0 15	36400.0 15	24100.0 18	14200.0 28	12400.0 23	11800.0 13	11700.0 11	8750.0 14	4760.0 22
1946	23300.0 38	22300.0 38	18900.0 38	14200.0 35	10900.0 36	8250.0 35	8320.0 31	7610.0 31	7180.0 25	4800.0 21
1947	28600.0 30	28100.0 30	24900.0 29	19800.0 28	14700.0 26	13400.0 20	11600.0 18	9490.0 21	8150.0 20	4960.0 18
1948	41800.0 19	39600.0 19	33600.0 19	23700.0 19	23100.0 9	14700.0 14	11600.0 19	9760.0 19	7460.0 22	4420.0 26
1949	48900.0 15	45900.0 13	38800.0 12	32000.0 8	26300.0 6	19500.0 4	15800.0 4	13700.0 6	10300.0 8	6050.0 10
1950	70400.0 2	67500.0 2	56800.0 1	49200.0 1	39200.0 1	29700.0 1	23600.0 1	20300.0 1	15000.0 1	8750.0 1
1951	30000.0 29	28800.0 29	27100.0 25	21900.0 24	14900.0 25	12000.0 24	11200.0 22	10700.0 16	9650.0 11	6000.0 11
1952	28500.0 31	27600.0 31	25300.0 28	23200.0 21	16900.0 20	14200.0 15	13700.0 10	12400.0 9	10300.0 9	6470.0 7
1953	26000.0 36	24800.0 36	20800.0 35	14100.0 36	11900.0 33	8750.0 34	7810.0 35	6670.0 35	5490.0 35	3370.0 35
1954	9100.0 45	8460.0 45	6920.0 44	5940.0 44	4980.0 43	3710.0 42	3150.0 42	2720.0 42	2150.0 42	1310.0 43
1955	14500.0 41	13700.0 40	12300.0 40	9150.0 40	8300.0 40	7430.0 38	6270.0 39	5750.0 38	4810.0 38	2920.0 38
1956	35200.0 23	32300.0 23	24500.0 30	15600.0 33	11400.0 35	9570.0 30	8240.0 32	8220.0 29	7150.0 26	5090.0 17
1957	51000.0 12	45300.0 14	34400.0 18	25500.0 17	18400.0 15	15800.0 8	15000.0 8	13900.0 2	10900.0 5	6220.0 9
1958	46200.0 16	43600.0 16	37500.0 13	29100.0 10	18500.0 14	13200.0 22	10300.0 25	9220.0 22	7708.0 21	6580.0 6
1959	35800.0 22	33900.0 22	29000.0 22	20300.0 27	18300.0 16	14200.0 16	11800.0 14	10700.0 17	8360.0 18	5190.0 16
1960	32200.0 26	29300.0 28	20100.0 36	13500.0 37	9480.0 38	7350.0 39	6640.0 37	6050.0 37	5830.0 33	3970.0 30
1961	67100.0 3	62500.0 3	48000.0 6	32300.0 6	24000.0 8	17900.0 7	15500.0 6	12900.0 8	9080.0 13	4920.0 20
1962	27800.0 32	25600.0 35	20000.0 37	14800.0 34	13400.0 30	10400.0 28	9340.0 27	8130.0 30	6490.0 29	4420.0 27
1963	55600.0 10	47700.0 12	37000.0 14	26600.0 14	21100.0 10	14200.0 17	10500.0 23	8360.0 28	5930.0 32	3560.0 31
1964	56600.0 8	52100.0 9	40000.0 11	25800.0 16	17700.0 18	15500.0 11	11600.0 20	9130.0 24	6540.0 28	3540.0 32
1965	22400.0 39	21500.0 39	17800.0 39	11400.0 39	10000.0 37	8080.0 36	8030.0 33	6650.0 36	5080.0 37	2980.0 37
1966	14600.0 40	13500.0 41	10000.0 42	6580.0 43	5230.0 42	3700.0 43	3810.0 41	3580.0 41	3060.0 41	1920.0 41
1967	43800.0 18	41000.0 18	34800.0 16	22400.0 22	14400.0 27	9350.0 31	8530.0 29	8390.0 26	8150.0 19	4690.0 23
1968	64700.0 5	56000.0 7	42100.0 8	26800.0 13	16100.0 21	11400.0 25	10500.0 24	10100.0 18	9270.0 12	5690.0 12
1969	65600.0 4	60000.0 4	48300.0 5	32200.0 7	24100.0 7	15600.0 10	11800.0 15	11300.0 12	8710.0 15	5690.0 13
1970	26800.0 35	25900.0 33	23500.0 32	16900.0 30	12000.0 32	8980.0 33	8690.0 28	8380.0 27	7080.0 27	4570.0 25
1971	34100.0 24	32200.0 24	27900.0 23	20900.0 26	15100.0 24	10700.0 26	8010.0 34	6890.0 33	5610.0 34	3500.0 33
1972	27600.0 33	26500.0 32	23700.0 31	21100.0 25	15800.0 23	10200.0 29	8380.0 30	7150.0 32	6380.0 30	3980.0 29
1973	25200.0 37	24600.0 37	21700.0 33	19100.0 29	18000.0 17	15000.0 12	11900.0 12	10900.0 13	11100.0 3	7730.0 2

APPENDIX D (CONTINUED)

WHITE RIVER AT NEWBERRY, IND.(Continued)

STATISTICS ON NORMAL MONTHLY MEANS(ALL DAYS)

BY ROWS(MEAN,VARIANCE,STANDARD DEVIATION, SKEWNESS, COEFF. OF VARIATION,PERCENTAGE OF AVERAGE FLOW)

OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
0.1220E+04	0.2465E+04	0.3883E+04	0.7016E+04	0.6783E+04	0.8185E+04	0.8788E+04	0.6509E+04	0.4390E+04	0.2907E+04	0.1529E+04	0.1161E+04
0.9897E+06	0.7119E+07	0.1484E+08	0.6954E+08	0.2555E+08	0.2022E+08	0.2606E+08	0.2683E+08	0.1168E+08	0.6407E+07	0.1540E+07	0.6808E+06
0.9948E+03	0.2668E+04	0.3826E+04	0.8339E+04	0.5055E+04	0.4497E+04	0.5105E+04	0.5180E+04	0.3417E+04	0.2531E+04	0.1241E+04	0.8251E+03
0.1842E+01	0.2321E+01	0.1469E+01	0.2102E+01	0.8666E+00	0.5467E+00	0.5722E+00	0.1818E+01	0.1578E+01	0.2136E+01	0.3420E+01	0.2342E+01
0.8156E+00	0.1082E+01	0.9851E+00	0.1189E+01	0.7452E+00	0.5494E+00	0.5810E+00	0.7958E+00	0.7784E+00	0.8707E+00	0.8116E+00	0.7109E+00
0.2224E+01	0.4496E+01	0.7082E+01	0.1280E+02	0.1237E+02	0.1493E+02	0.1602E+02	0.1187E+02	0.8006E+01	0.5302E+01	0.2789E+01	0.2117E+01

STATISTICS ON NORMAL ANNUAL MEANS(ALL DAYS)

MEAN	VARIANCE	STANDARD DEVIATION	SKEWNESS	COEFF. OF VARIATION	SERIAL CORR
0.4557E+04	0.3288E+07	0.1813E+04	-0.5077E-01	0.3980E+00	0.2888E+00

STATISTICS ON LOG MONTHLY MEANS(ALL DAYS)

BY ROWS(MEAN,VARIANCE,STANDARD DEVIATION, SKEWNESS, COEFF. OF VARIATION,PERCENTAGE OF AVERAGE FLOW)

OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
0.2975E+01	0.3194E+01	0.3373E+01	0.3588E+01	0.3682E+01	0.3834E+01	0.3860E+01	0.3701E+01	0.3532E+01	0.3334E+01	0.3092E+01	0.2983E+01
0.9146E-01	0.1698E+00	0.2112E+00	0.2480E+00	0.1617E+00	0.8559E-01	0.8306E-01	0.1024E+00	0.9575E-01	0.1137E+00	0.7878E-01	0.6789E-01
0.3024E+00	0.4121E+00	0.4598E+00	0.4980E+00	0.4021E+00	0.2926E+00	0.2882E+00	0.3200E+00	0.3094E+00	0.3372E+00	0.2806E+00	0.2606E+00
0.4930E+00	0.3665E+00	-0.1598E-01	-0.1088E-01	-0.5357E+00	-0.1005E+01	-0.4298E+00	-0.1310E+00	0.2487E+00	0.1399E+00	0.9350E-01	0.3973E+00
0.1016E+00	0.1290E+00	0.1363E+00	0.1389E+00	0.1092E+00	0.7631E-01	0.7465E-01	0.8646E-01	0.8761E-01	0.1011E+00	0.9077E-01	0.8734E-01
0.7231E+01	0.7763E+01	0.8198E+01	0.8715E+01	0.8949E+01	0.9317E+01	0.9382E+01	0.8994E+01	0.8504E+01	0.8103E+01	0.7514E+01	0.7250E+01

STATISTICS ON LOG ANNUAL MEANS(ALL DAYS)

MEAN	VARIANCE	STANDARD DEVIATION	SKEWNESS	COEFF. OF VARIATION	SERIAL CORR
0.3614E+01	0.4749E-01	0.2179E+00	-0.1193E+01	0.6030E-01	0.2307E+00

ANNUAL PEAKS

1897	69300	1941	11600
1908	37700	1942	32000
1909	22100	1943	76900
1910	31800	1944	53600
1911	21800	1945	53600
1912	29800	1946	23900
1913	130000	1947	28900
1914	22700	1948	43500
1915	25600	1949	49800
1916	97100	1950	71500
1917	44500	1951	30200
1918	23300	1952	28800
1919	59600	1953	26300
1920	42100	1954	9100
1921	37000	1955	15100
1922	52600	1956	37900
1923	30800	1957	52700
1924	27600	1958	48000
1925	19100	1959	37400
1926	48900	1960	34100
1927	54600	1961	69300
1928	22400	1962	28100
1929	38800	1963	55600
1930	60700	1964	57600
1931	11400	1965	22500
1932	37500	1966	14800
1933	56200	1967	44600
1934	13600	1968	67700
1935	32800	1969	66800
1936	27100	1970	27100
1937	65900	1971	34500
1938	47600	1972	27800
1939	50200	1973	25500
1940	31800		

APPENDIX E

LOW-FLOW CHARACTERISTICS FOR SELECTED STREAMS IN GREENE COUNTY (8)

APPENDIX E–1. LOW–FLOW CHARACTERISTICS OF THE WHITE RIVER (8).

LOCATION.--Lat 38°55'42", long 87°01'00", in sec. 25, T. 6 N., R. 6 W., Greene County, on right bank 500 ft upstream from bridge on State Highway 57 at Newberry, 2.3 miles downstream from Doans Creek, and at mile 118.0.

DRAINAGE AREA.--4,688 sq mi.

DISCHARGE DATA AVAILABLE.--September 1928 to September 1967. Prior to October 1948, published as West Fork White River at Newberry.

SELECTED DISCHARGE CHARACTERISTICS.--

Average discharge:	4,459 cfs (39 years)
Minimum daily discharge:	200 cfs October 1941
1-day, 30-year low flow:	232 cfs

WATER INTAKES AND SEWER OUTFALLS.--Flow slightly regulated by four reservoirs above station.

Magnitude and frequency of annual low flow

Period (Consecutive days)	Discharge, in cfs, for indicated recurrence interval, in years				
	2	5	10	20	50
1	465	338	286	250	214
3	476	350	298	256	220
7	490	356	300	261	223
14	520	369	310	268	230
30	570	400	337	295	255
60	690	460	383	330	280

Magnitude and frequency of summer low flow

Period (Consecutive days)	Discharge, in cfs, for indicated recurrence interval, in years				
	2	5	10	20	50
1	700	472	380	310	242
3	720	486	390	314	250
7	770	510	405	330	257
14	830	530	428	356	293
30	1,060	630	490	400	325
60	1,620	910	660	510	389

Duration of daily flow for indicated period

Months	Period	Discharge, in cfs, which was exceeded for indicated percent of time during 1929-67 water years							
		98	95	90	80	70	50	20	10
3	Aug.-Oct.	283	347	406	490	580	840	1,510	2,270
6	May-Oct.	330	406	480	650	850	1,420	3,700	6,300
3	June-Aug.	376	472	610	860	1,070	1,590	3,550	6,000
12	Oct.-Sept.	370	433	530	750	1,010	2,020	6,000	10,600

APPENDIX E—2. LOW—FLOW CHARACTERISTICS OF RICHLAND CREEK (8).

Richland Creek near Bloomfield, Ind.

LOCATION.--Lat 39°01'38", long 86°54'25", in NE 1/4 SE 1/4 sec. 24, T. 7 N., R. 5 W., Greene County, at bridge on State Highway 54, 1.9 miles east of Bloomfield.

DRAINAGE AREA.--95.4 sq mi.

DISCHARGE DATA AVAILABLE.--Low-flow measurements, 1960-65, 1967 water years.

SELECTED DISCHARGE CHARACTERISTICS.--Minimum flow observed: 0.9 cfs October 1964
7-day, 2-year low flow: 1.9 cfs
7-day, 10-year low flow: .5 cfs
50% daily flow duration: 24 cfs
90% daily flow duration: 2.8 cfs

APPENDIX E—3. LOW—FLOW CHARACTERISTICS OF LATTAS CREEK (8).

Lattas Creek at Switz City, Ind.

LOCATION.--Lat 39°02'40", long 87°02'38", in SE 1/4 sec. 14, T. 7 N., R. 6 W., Greene County, at bridge on State Highway 67, 0.9 mile north of Switz City.

DRAINAGE AREA.--32.7 sq mi.

DISCHARGE DATA AVAILABLE.--Low-flow measurements, 1954, 1960-65, 1967 water years.

SELECTED DISCHARGE CHARACTERISTICS.--

Minimum flow observed:	No flow most of the time
7-day, 2-year low flow:	0 cfs
7-day, 10-year low flow:	0 cfs
50% daily flow duration:	1.1 cfs
90% daily flow duration:	0 cfs

APPENDIX E-4. LOW-FLOW CHARACTERISTICS OF PLUMMER CREEK (8).

Plummer Creek near Bloomfield, Ind.

LOCATION.--Lat 38°59'33", long 86°55'44", in NE 1/4 sec. 2, T. 6 N., R. 5 W., Greene County, at bridge on U.S. Highway 231, 2.3 miles south of Bloomfield.

DRAINAGE AREA.--66.7 sq mi.

DISCHARGE DATA AVAILABLE.--Low-flow measurements, 1954, 1968-70 water years.

SELECTED DISCHARGE CHARACTERISTICS.--

Minimum flow observed:	No flow July 1954
7-day, 2-year low flow:	0.2 cfs
7-day, 10-year low flow:	0 cfs
50% daily flow duration:	7.8 cfs
90% daily flow duration:	.6 cfs

APPENDIX F

LOESS THICKNESS MEASUREMENTS IN GREENE COUNTY (24)

APPENDIX F. LOESS THICKNESS MEASUREMENTS IN GREENE COUNTY (24).

Site No.	Township	Range	Section	Total Depth in Inches	Underlying Material
1	6N	7W	32,NW40,SE10	55	Illinoian till
2	6N	7W	24,SW10	65	Illinoian till
3	6N	6W	9,SW40,SE10	70	Illinoian outwash
4	6N	5W	7,SW160,NW40	72	Illinoian outwash
5	7N	5W	32,NE160,SW10	65	Illinoian till
6	7N	6W	24,NW160,NE40	55	Illinoian till
7	7N	6W	17,SE10	45	Illinoian till
8	8N	6W	31,SW10	48	Illinoian till
9	8N	6W	26,SW160,NW10	50	Illinoian till
10	8N	6W	25,NE40	65	Illinoian till
11	8N	6W	12,NW160,SW10	62	Illinoian till
12	8N	5W	7,SE160,NW40	62	Sandstone residuum
13	8N	5W	4,NE160,NW10	65	Illinoian till
14	8N	5W	10,SE160,SW10	72	Illinoian till
15	8N	5W	21,NE160,NW40	125	Illinoian till
16	8N	5W	23,SE160,SW40	75	Illinoian till
17	8N	4W	17,SE160,NW40	55	Sandstone residuum
18	8N	4W	13,SW160,SE40	45	Sandstone
19	8N	3W	28,NW160,SW10	40	Sandstone & Shale residuum
20	7N	3W	16,SE40	40	Sandstone & Shale
21	7N	4W	16,SE40	38	Sandstone & Shale residuum
22	7N	5W	25,SE160,SW40	70	Illinoian till
23	6N	5W	2,SE40,SW10	70	Illinoian till
24	6N	4W	7,NW160,SE40	55	Illinoian till
25	6N	4W	4,SE160,SW40	45	Sandstone residuum
26	6N	3W	28,NE160,SW40	40	Sandstone & Shale residuum
27	6N	4W	26,SW160,SE40	40	Sandstone & Shale residuum
28	6N	5W	35,NW40,SE10	55	Illinoian till
29	6N	5W	30,SE40,SW10	70	Illinoian till
30	7N	5W	14,NW160,SW40	80	Illinoian till
31	8N	5W	17,NW1/4	55	Sandy loam
32	8N	5W	7,NE160,SW40	42	Sandstone residuum
33	8N	6W	11,SW160	70	Illinoian till
34	8N	6W	9,SE160	45	Illinoian till
35	8N	7W	10,SE160	72	Illinoian till
36	7N	7W	3,SW160	60	Illinoian till
37	7N	4W	26,NW160	40	Illinoian till

JHRP- 89/6

LEGEND

PARENT MATERIALS
(GROUPED ACCORDING TO LAND FORM AND ORIGIN)

- SANDSTONE-SHALE PLATEAU WITH LOESS MANTLE
- ILLINOIAN GROUND MORAINE WITH LOESS MANTLE
- ILLINOIAN SLACKWATER TERRACE
- ILLINOIAN OUTWASH PLAIN
- WISCONSINAN SLACKWATER PLAIN
- WISCONSINAN OUTWASH TERRACE
- SAND DUNES
- LIMESTONE PLATEAU
- LIMESTONE BENCH
- FLOOD PLAIN
- OXBOW
- MUCK AND PEAT DEPOSITS

MISCELLANEOUS

- COAL-STRIP MINES
- GRAVEL PITS
- LAKE OR POND
- URBAN AREA
- BORING SITES

TEXTURAL SYMBOLS
(SUPERIMPOSED ON PARENT MATERIAL TO SHOW RELATIVE COMPOSITION)

- GRAVEL
- SAND
- SILT
- CLAY

ENGINEERING SOILS MAP
GREENE COUNTY
INDIANA

PREPARED FROM

1937 AAA AERIAL PHOTOGRAPHS

BY

JOINT HIGHWAY RESEARCH PROJECT

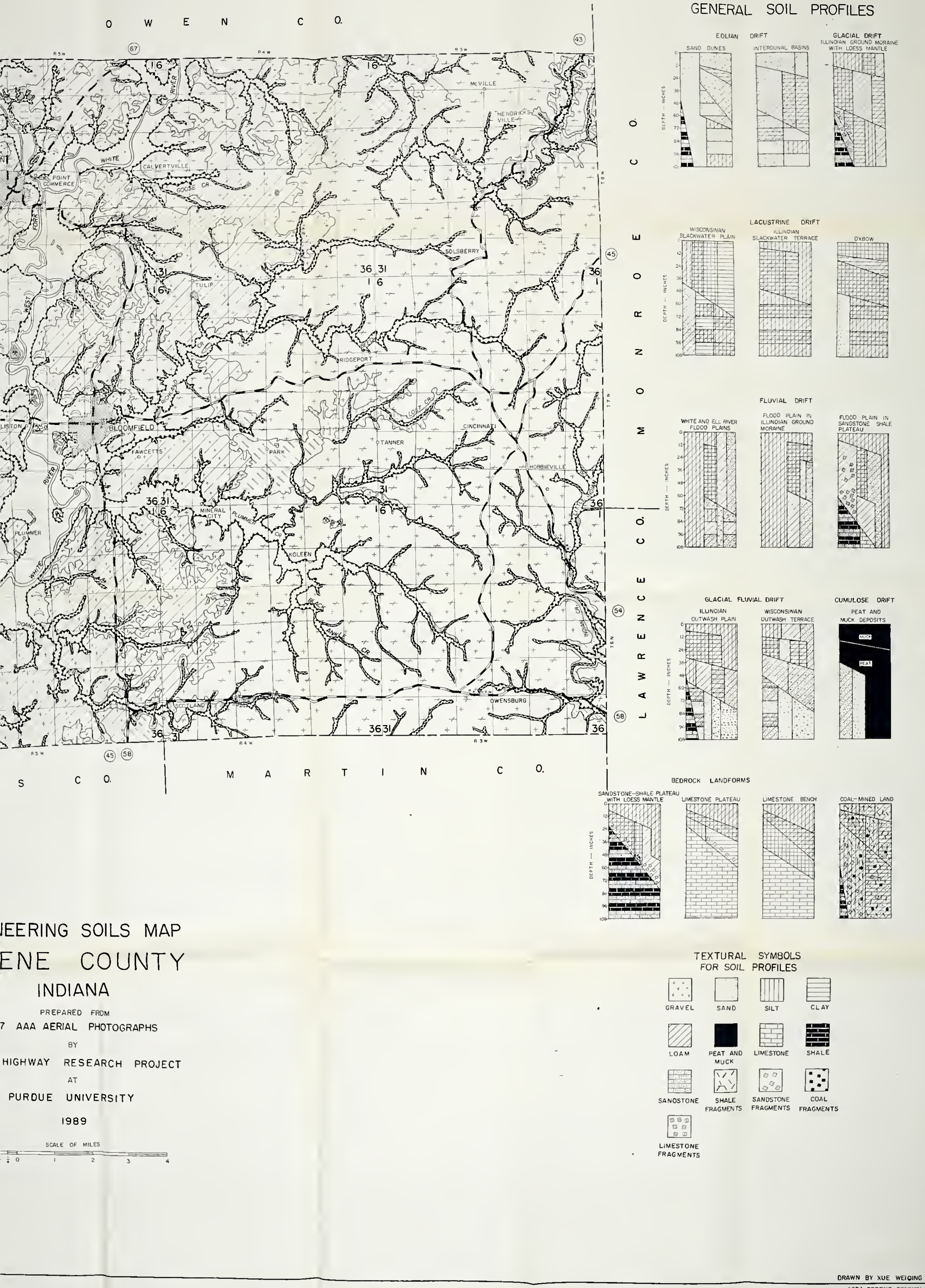
AT

PURDUE UNIVERSITY

1989

SCALE OF MILES

PREPARED UNDER THE SUPERVISION OF G.L. JOHNSON AND R.D. MILES



OWEN CO.
MONROE CO.
LAWRENCE CO.
MARTIN CO.
S CO.
R 5 W
R 4 W
R 3 W
T 8 N
T 7 N
T 6 N
McVILLE
HENDRICKSVILLE
CALVERTVILLE
POINT COMMERCE
WHITE RIVER
WEST FORK
GOOSE CR.
SOLSBERRY
TULIP
RIDGEPORT
BLOOMFIELD
LISTON
FAWCETTS
PARK
CINCINNATI
TANNER
HOBBIEVILLE
MINERAL CITY
PLUMMER
KOLEEN
DOANS
SCOTLAND
OWENSBURG
INDIAN CR.
GENERAL SOIL PROFILES
EOLIAN DRIFT
SAND DUNES
INTERDUNAL BASINS
GLACIAL DRIFT
ILLINOIAN GROUND MORAINE WITH LOESS MANTLE
LACUSTRINE DRIFT
WISCONSINAN SLACKWATER PLAIN
ILLINOIAN SLACKWATER TERRACE
OXBOW
FLUVIAL DRIFT
WHITE AND ELL RIVER FLOOD PLAINS
FLOOD PLAIN IN ILLINOIAN GROUND MORAINE
FLOOD PLAIN IN SANDSTONE SHALE PLATEAU
GLACIAL FLUVIAL DRIFT
ILLINOIAN OUTWASH PLAIN
WISCONSINAN OUTWASH TERRACE
CUMULOSE DRIFT
PEAT AND MUCK DEPOSITS
MUCK
PEAT
BEDROCK LANDFORMS
SANDSTONE-SHALE PLATEAU WITH LOESS MANTLE
LIMESTONE PLATEAU
LIMESTONE BENCH
COAL-MINED LAND
DEPTH — INCHES
TEXTURAL SYMBOLS FOR SOIL PROFILES
GRAVEL
SAND
SILT
CLAY
LOAM
PEAT AND MUCK
LIMESTONE
SHALE
SANDSTONE
SHALE FRAGMENTS
SANDSTONE FRAGMENTS
COAL FRAGMENTS
LIMESTONE FRAGMENTS
…EERING SOILS MAP
…ENE COUNTY
INDIANA
PREPARED FROM
…7 AAA AERIAL PHOTOGRAPHS
BY
HIGHWAY RESEARCH PROJECT
AT
PURDUE UNIVERSITY
1989
SCALE OF MILES
DRAWN BY XUE WEIQING
(28) GREENE COUNTY

COVER DESIGN BY ALDO GIORGINI